

Report No. CG-D-24-94

## Coast Guard Vessel Preliminary Hazard Analysis

William A. Wheeler  
Rhonda A. Kinghorn  
John D. Lee  
Mireille Raby  
Alvah C. Bittner, Jr.

Human Factors Transportation Center  
Battelle Seattle Research Center  
Seattle, WA 98105-5428

and

William H. Jones

U.S. Coast Guard  
Research and Development Center  
1082 Shennecossett Road  
Groton, CT 06340-6096



Final Report  
December 1994

This document is available to the U.S. public through the  
National Technical Information Service, Springfield, Virginia 22161

Prepared for:

U.S. Department of Transportation  
United States Coast Guard  
Office of Engineering, Logistics, and Development  
Washington, DC 20593-0001

DTIC  
ELECTE  
JAN 25 1995  
S G D

19950123 029

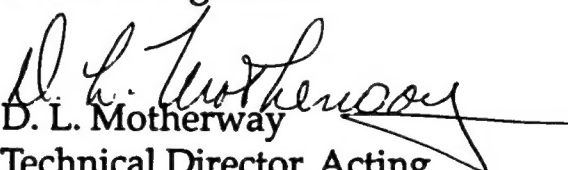
# NOTICE

This document is disseminated under the sponsorship of the Department of Transportation in the interest of information exchange. The United States Government assumes no liability for its contents or use thereof.

The United States Government does not endorse products or manufacturers. Trade or manufacturers' names appear herein solely because they are considered essential to the object of this report.

The contents of this report reflect the views of the Coast Guard Research & Development Center. This report does not constitute a standard, specification, or regulation.



  
D. L. Motherway  
Technical Director, Acting  
United States Coast Guard  
Research & Development Center  
1082 Shennecossett Road  
Groton, CT 06340-6096

1. Report No. <b>CG-D-24-94</b>		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle <b>Coast Guard Vessel Preliminary Hazard Analysis</b>				5. Report Date <b>December 1994</b>	
7. Author(s) <b>William A. Wheeler, Rhonda A. Kinghorn, John D. Lee, Mireille Raby, Alvah C. Bittner, Jr. and William H. Jones</b>				6. Performing Organization Code <b>MFRSB Report No. 97</b>	
				8. Performing Organization Report No. <b>R&amp;DC 31/94</b>	
9. Performing Organization Name and Address  <b>Human Factors Transportation Center U.S. Coast Guard Battelle Seattle Research Center Research and Development Center Seattle, WA 98105-5428 Marine Fire and Safety Research Branch 1082 Shennecossett Road Groton, CT 06340-6096</b>				10. Work Unit No. (TRAIS)	
12. Sponsoring Agency Name and Address <b>Department of Transportation U.S. Coast Guard Office of Engineering, Logistics, and Development Washington, DC 20593-0001</b>				11. Contract or Grant No. <b>ARO DAAL03-91-C-0034</b>	
				13. Type of Report and Period Covered <b>Final Report December 1994</b>	
14. Sponsoring Agency Code					
15. Supplementary Notes  <b>The Coast Guard technical contact and COTR is Mr. William Jones, 203-441-2764.</b>					
16. Abstract  <b>A non-traditional Preliminary Hazard Analysis (PHA) technique, based solely on historical mishap data, is presented. The PHA characterizes and presents hazards in a tabular format for easy viewing and understanding. This method focuses management attention on critical issues necessary to lower the vessel risk level. The traditional approach to conducting a PHA is to review vessel designs, conduct crew interviews, inspect the vessel, and review mishap histories. In an attempt to condense the background investigation aspect of the PHA and take advantage of the Coast Guard's extensive historical mishap information, this PHA was conducted solely using the information contained in the Loss Exposure and Risk Analysis Method (LERAM) Project Database. The LERAM Project database is an enhanced version of the Coast Guard's Mishap Reporting System (MISREPS) database. The LERAM Project database served as the basis for the vessel hazard hierarchy, and the PHA.</b>					
17. Key Words  <b>Preliminary Hazard Analysis (PHA) vessel hazards vessel hazard groups</b>			18. Distribution Statement  <b>This document is available to the U.S. public through the National Technical Information Service, Springfield, VA 22161.</b>		
19. Security Classif. (of this report) <b>UNCLASSIFIED</b>		20. SECURITY CLASSIF. (of this page) <b>UNCLASSIFIED</b>		21. No. of Pages	
				22. Price	

# METRIC CONVERSION FACTORS

## Approximate Conversions to Metric Measures

Symbol When You Know Multiply By To Find Symbol

### LENGTH

in	inches	* 2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km

### AREA

in <sup>2</sup>	square inches	6.5	square centimeters	cm <sup>2</sup>
ft <sup>2</sup>	square feet	0.09	square meters	m <sup>2</sup>
yd <sup>2</sup>	square yards	0.8	square meters	m <sup>2</sup>
mi <sup>2</sup>	square miles	2.6	square kilometers	km <sup>2</sup>
	acres	0.4	hectares	ha

### MASS (WEIGHT)

oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t

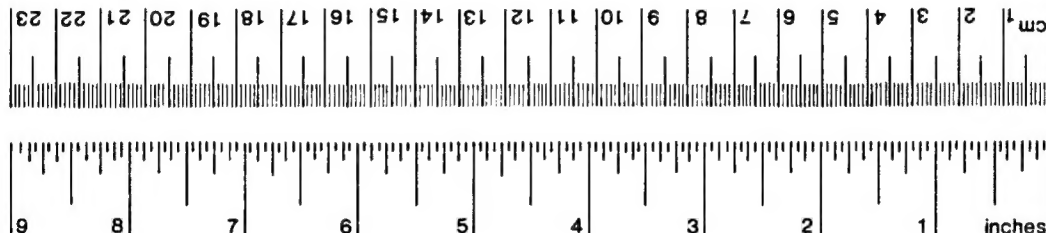
### VOLUME

tsp	teaspoons	5	milliliters	ml
tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft <sup>3</sup>	cubic feet	0.03	cubic meters	m <sup>3</sup>
yd <sup>3</sup>	cubic yards	0.76	cubic meters	m <sup>3</sup>

### TEMPERATURE (EXACT)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C
----	------------------------	----------------------------	---------------------	----

\*1 in = 2.54 (exactly).



## Approximate Conversions from Metric Measures

Symbol When You Know Multiply By To Find Symbol

### LENGTH

mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi

### AREA

cm <sup>2</sup>	square centimeters	0.16	square inches	in <sup>2</sup>
m <sup>2</sup>	square meters	1.2	square yards	yd <sup>2</sup>
km <sup>2</sup>	square kilometers	0.4	square miles	mi <sup>2</sup>
ha	hectares (10,000 m <sup>2</sup> )	2.5	acres	ac

### MASS (WEIGHT)

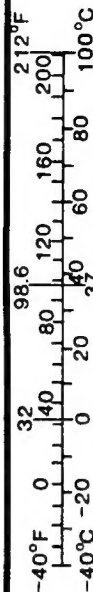
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	st

### VOLUME

ml	milliliters	0.03	fluid ounces	fl oz
l	liters	0.125	cups	c
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m <sup>3</sup>	cubic meters	35	cubic feet	ft <sup>3</sup>
m <sup>3</sup>	cubic meters	1.3	cubic yards	yd <sup>3</sup>

### TEMPERATURE (EXACT)

°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F
----	---------------------	-------------------	------------------------	----





## TABLE OF CONTENTS

	Page
1.0 INTRODUCTION.....	1
1.1 Background.....	1
1.2 Description of Project/Report.....	2
2.0 HAZARD GROUPS.....	2
2.1 Background.....	2
2.2 Development of Vessel Hazard Groups.....	2
2.2.1 Review of Various Taxonomies.....	3
2.2.2 Database Review.....	4
3.0 HAZARD LIST.....	5
3.1 Background.....	5
3.2 Development of the Vessel Hazard List.....	5
4.0 VESSEL HAZARD HIERARCHY.....	6
4.1 Background.....	6
4.2 Development of the System Hazard Hierarchy.....	6
5.0 PRELIMINARY HAZARD ANALYSES.....	7
5.1 Background.....	7
5.2 Development of the Preliminary Hazard Analyses.....	8
6.0 VESSEL HAZARD MATRIX.....	9
6.1 Background.....	9
6.2 Development of the Vessel Hazard Matrix.....	9
7.0 RECOMMENDATIONS.....	10
7.1 Background.....	10
7.2 Advantages and Disadvantages of the Database Approach.....	11
7.3 Conclusion.....	11
8.0 REFERENCES.....	12
 APPENDICES	
A COAST GUARD VESSEL SYSTEM HAZARD GROUPS.....	A-1
B COAST GUARD VESSEL SYSTEM HAZARD LISTING.....	B-1
C COAST GUARD VESSEL SYSTEM HAZARD HIERARCHY.....	C-1
D COAST GUARD VESSEL SYSTEM PRELIMINARY HAZARD ANALYSIS...	D-1
E COAST GUARD VESSEL SYSTEM HAZARD MATRIX.....	E-1

## LIST OF TABLES

	Page
1. Comparison of Hazard Taxonomies and Existing Mishap Reporting Structures.....	4
2. Coast Guard System Definitions.....	10

## 1.0 INTRODUCTION

### 1.1 Background

The Coast Guard is developing a Loss Exposure and Risk Analysis Method (LERAM) to improve the management and control of loss exposures and risks aboard its vessels. Though the Coast Guard has extensive safety related programs, they generally focus on specific aspects of the system. When developed, LERAM will provide a method for the Coast Guard to characterize hazards and assess the risks associated with those hazards onboard its fleet of over 2200 cutters and boats. In addition, this method will integrate various safety management methods and programs to achieve a system wide vessel safety program. Such a system wide approach to vessel safety will cost-effectively reduce the risks to Coast Guard personnel, property, operations, and the environment.

To support the LERAM project, the Coast Guard Research and Development Center has captured, corrected, and enhanced the Mishap Reporting System (MISREPS) database for the years 1989 through 1992. This integrated database, called the LERAM project database, contains historical information on Coast Guard Vessel mishaps and operating experience. This database formed the basis of a historical analysis of vessel mishaps [1]. The present project, to characterize Coast Guard vessel hazards, is the next logical step in the process of developing LERAM. The method chosen for initially characterizing vessel hazards is a Preliminary Hazard Analysis (PHA). It should be noted that a PHA is usually developed from a detailed engineering analysis of vessel drawings and related specifications and thus is a prospective approach. The method prescribed in this project calls for the PHA to be developed on the basis of a retrospective analysis of Coast Guard vessel history, particularly as this history has included vessel mishaps. The one advantage is that the enhanced database was designed to support automated first level PHA listings.

A PHA provides a qualitative assessment of the hazardous conditions and potential accidents within a system [2]. Though the PHA is usually performed in the early phases of system development [3,4,5], it can also be the first step in a more rigorous safety analysis [6] of existing systems. The PHA is presented in a tabular/textual format that allows characterization of each hazard in a variety of ways. Hazards described in the PHA can also form the basis for other hierarchical hazard analysis techniques such as Failure Modes and Effects Analysis (FMEA) and Fault Tree Analysis (FTA).

The development of a generic PHA that will include the various hazards that might be found on Coast Guard vessels is an ambitious project. Coast Guard vessels represent complex arrangements of systems, sub-systems, and components. In addition to complexity, the wide variety of Coast Guard vessels present significant challenges to the development of a comprehensive listing of all main hazards that may need to be considered for a particular vessel. The complexity and variety of Coast Guard vessels requires the careful development of a taxonomy of vessel hazards if a successful PHA is to be performed.

<input checked="checked" type="checkbox"/>	
<input type="checkbox"/>	
<input type="checkbox"/>	
Distribution /	
Availability Codes	
Dist	Avail and/or Special
A-1	

## **1.2 Description of Project/Report**

This report presents the culmination of five tasks that led to the development of the Preliminary Hazard Analyses. The PHA characterizes the majority of Coast Guard vessel hazards and organizes them into generic hazard groups. The tasks are as follows:

1. Identification of hazard groups.
2. Creation of a hazard list.
3. Development of a hazard hierarchy.
4. Performance of PHA on LERAM project database material.
5. Creation of a vessel hazard matrix.

All tasks of the project used an iterative process. Typically, team members would work on a separate part of each task. The team members then reviewed each others' work to maintain consistency throughout each task. In particular, the development of the hazard list and the PHA involved several iterations whereby new information that was gained during each task was incorporated into other tasks. The activities involved in each of these tasks and their results are described in the appendices.

## **2.0 HAZARD GROUPS**

### **2.1 Background**

The first step in developing the preliminary hazard analysis was the development of generic hazard groups that could be used to characterize Coast Guard vessel hazards. In addition to identifying and defining hazard groups, we also identified how each hazard group would relate to the Coast Guard Vessel Systems (i.e., Operating Systems, Engineering Systems, Management Systems, and the Environment).

While developing the vessel hazard groups, it was determined that it would not be possible to accurately link hazard groups with vessel systems without a detailed understanding of the incidents, hazards, and results that were associated with each reported mishap. During the technical interchange meetings held February 15-16, 1994, it was determined that this linkage would be best accomplished by developing a Vessel Hazard Matrix. The hazard matrix would identify hazard groups that had a primary or secondary effect on the four major vessel systems mentioned in the first paragraph of this section.

### **2.2 Development of Vessel Hazard Groups**

Two approaches were used in the development of vessel hazard groups. The first technique involved researching and reviewing existing hazard group taxonomies developed for related environments such as marine and Department of Defense applications. The second method

involved reviewing the historical vessel mishaps recorded in the MISREPS database to identify and characterize hazard groupings associated with prior mishaps reported during the 1989-1992 time period. Additional details of these approaches are described below.

### **2.2.1 Review of Various Taxonomies**

Safety and hazard analysis literature was researched to identify a common taxonomy for describing vessel related hazard groups and detailed hazards associated with the broader hazard groups. There are several advantages to using a commonly accepted hazard taxonomy. These include:

- The availability of commonly used terminology to define the hazard.
- A developed structure that provides unambiguous grouping of lower level hazards.
- The potential for using the results of safety analyses conducted on other systems as the basis for developing the PHA on the system of interest.

Though it was desirable to use a previously developed hazard group taxonomy as the starting point for the PHA, it was recognized that such a taxonomy must be compatible with the needs of the Coast Guard. In particular, the taxonomy should work within the existing vessel mishap reporting system so that hazard groups may be identified and assigned to vessel mishaps. To facilitate smooth integration into the vessel safety structure the taxonomy would be designed so safety professional assign the hazard groups, eliminating confusion for the reporting personnel and the need for changing the reporting forms. Integrating hazard groups into the MISREPS database is easily facilitated by adding a hazard group table to the existing structure rather than re-coding a new required data element.

Several taxonomies were considered as a possible basis for grouping Coast Guard Vessel Hazards. The existing Mishap Types developed as part of the MISREPS database enhancement project (Romberg, Ryley, & Wolverton of CompuCon, 1993), plus two published hazard group taxonomies (Hammer, 1972, 1989; and Cheaney and Coyle, 1977) are listed in Table 1 along with Battelle's proposed hazard group taxonomy. In table 1, we attempt to link the hazard groups defined in each taxonomy to illustrate how the proposed taxonomy provides the greatest coverage of vessel hazards and the closest linkage to the existing mishap reporting structure.

**Table 1. Comparison of Hazard Taxonomies and Existing Mishap Reporting Structures.**

<b>BATTELLE'S APPROACH</b>	<b>MISHAP TYPES (ROMBERG ET AL., 1993)</b>	<b>HAMMER (1972, 1989)</b>	<b>CHEANEY &amp; COYLES (1977)</b>
Armaments and Military Explosives	Firearm discharge		
Radiation Burns	Hazardous exposure: Radiation Burn	Radiation Infrared Electromagnetic Ionizing Ultraviolet	
Capsize	Capsizing		
Collision with vessel Collision with object Grounding	Collision with another vessel Collision with an object Collision with a floating object Grounding	Impact and Shock	Collision, ramming, grounding
Contamination		Contamination	
Electrical	Electrical shock/electrocution	Electrical	
Environmental conditions	Environmental-related injuries	Weather and environment	
Equipment Failure Structural Failure	Equipment failure	Structural damage/failure	Structural failure
Ergonomic			
Explosion Fire	Fire/Explosion	Fire/Explosion	Fire/Explosion
Flooding/Sinking	Flooding Sinking		
Impact and shock	Fall	Impact and shock	
Leakage		Leakage	Hazardous cargo spill
Loss of power/control	Fouled screw	Power source failure	
Mechanical	Equipment-related injury	Mechanical	
Overboard	Drowning Overboard		Occupational accidents
Temperature contact	Hazardous exposure: cold Hazardous exposure: heat Burns Equipment-related injury	Heat and temperature High temperature Low temperature Temperature variation	
Toxicity	Hazardous exposure: chemical Burns	Toxicity	
Vibration and noise	Noise	Vibration and noise	

### 2.2.2 Database Review

The second approach was to review the contents of the LERAM project database for incidents reported during the 1989-1992 time period. This review concentrated on the type of mishap (vessel and personnel) described in the database. In addition to the type of mishap, a review was also conducted of mishap narratives to determine if these narratives might indicate additional hazards not identified by either the review of existing hazard taxonomies or the coded mishap types.

By mapping the contents of previously developed hazard taxonomies to the mishaps types found in the LERAM project database, it was possible to develop hazard groups that were sufficiently broad to incorporate the majority of vessel hazards. The hazard group definitions are presented in Appendix A.

### **3.0 HAZARD LIST**

#### **3.1 Background**

Once the vessel hazard group taxonomy had been developed, the next task in the development of the preliminary hazard analysis was to identify the hazards associated with each mishap reported in the LERAM project database and correlate these with the hazard groups. The hazard listing, organized by the LERAM project database mishap number, identifies the primary hazard group associated with the mishap and up to two additional hazard groups, plus up to six hazards associated with the mishap and the identified hazard groups. The descriptions of the hazards are brief due in part to the size of the table used to present the information and secondly from the lack of detailed information available from the LERAM project database.

A preliminary evaluation of the data available in the LERAM project database indicated that identification of the system or subsystem affected by a particular hazard could not be generally determined. During the technical interchange meeting held on February 15-16, 1994, at Battelle, it was agreed that such information would not be included in the hazard list. During the technical interchange meeting held on April 5, 1994, at the Coast Guard Research and Development Center, it was agreed that an electronic copy of the resulting listing would be provided as part of this report in order to allow more detailed analysis of the information by the Coast Guard at a later date.

#### **3.2 Development of the Vessel Hazard List**

As part of the initial work in this project, the system safety and hazard analysis literature was researched to determine possible hazards associated with the hazard groups described in the previous section. This approach was not very useful for creating the Coast Guard Vessel Hazard List as hazards mentioned in the literature tended to be either very general or domain-specific. While this background information was useful in identifying hazards that are typically associated with mishaps, they did not contribute significantly to the development of the Vessel Hazard List. An analysis of the content of each mishap contained in the LERAM project database, including the descriptions of the event and its consequences, provided the basic information from which hazards could be identified and characterized.

A five-step interactive process was used to identify hazards for each of the mishaps contained in the LERAM project database. These steps were as follows:

1. A review of the entire LERAM project database was made to remove incomplete mishaps from consideration.



2. A separate database of mishaps was constructed to contain the following fields:
  - Mishap number
  - Generic Hazard Groups (three fields were available)
  - Specific Vessel Hazard (six fields were available)
  - Effect of the Hazard
  - Vessel Class
  - Hazard Level (i.e., Mishap Class)
  - Personnel Cost
  - Government Property Cost
  - Other Property Cost
  - Total Cost
3. This Hazard List database was completed during these iterations of the LERAM project database by the team of safety analysts. The first iteration was used to identify the vessel hazard group or groups associated with each mishap. The second iteration was used to identify the major effects in terms of injury and property damage that were associated with each mishap. The last iteration was used to identify the likely vessel hazards associated with each mishap.
4. Once the Hazard List database was completed, each of the new fields added (i.e., vessel hazard groups, vessel hazards, and hazard effects) were reviewed to insure use of common terminology throughout the list.
5. The resulting list of hazard groups, specific hazards, and effects are presented in Appendix B. The entire Hazard List database, in EXCEL 4.0 format, is provided as an enclosure to this report and is labeled HAZLIST.XLS.

#### **4.0 VESSEL HAZARD HIERARCHY**

##### **4.1 Background**

Once vessel hazards from the 1989 to 1992 LERAM project database were identified and characterized, they were ranked first according to the severity of the consequences, second by hazard group, and third by probability. The purpose of such a ranking was to provide the Coast Guard with a representation of historical experience concerning hazards and their consequences.

During the technical interchange meeting held on April 5, 1994, at the Coast Guard Research and Development Center, it was agreed that the hazard hierarchy would also include vessel classes.

##### **4.2 Development of the System Hazard Hierarchy**

The Vessel System Hazard Hierarchy was based on information contained in a database developed to contain the hazard list. This database consisted of a single record for each mishap contained in the LERAM project database that contained enough information about the mishap to identify hazards which contributed to the mishap. There were 1,242 such usable mishaps in the LERAM project database.

Each record of the Vessel System Hazard List database consisted of the following fields:

- Mishap Number
- Vessel Hazard Group (three fields possible)
- Vessel Hazard (6 fields possible)
- Effects of the hazard in terms of injury or damage
- Vessel Class
- Hazard Level (i.e., Mishap Class)
- Cost to personnel
- Cost to government property
- Cost to other property
- Total Cost

Of these fields, Hazard Group, Vessel Class, and Hazard Level were used to develop the hierarchy. The following steps were used in developing the System Hazard Hierarchy:

1. The database was reorganized to create a single record for each hazard group identified in the original database. This was necessary because many of the mishaps had been identified as having more than one hazard group and more than one hazard associated with them. The resulting listing then consisted of a separate record for each hazard group entry for an mishap. Thus if a mishap was identified with two or three hazard groups it would show up in the listing two or three times. The information on vessel class and hazard level would also be duplicated in these additional entries. When this process was completed, 1,814 entries were used for the development of the hazard hierarchy.
2. The hierarchy was sorted first by Hazard Level, then by Hazard Group within each Hazard Level, and finally by Vessel Class within each Hazard Group occurring in a particular hazard level.
3. To provide a representation of the relative importance of each element within the hierarchy, the probability of occurrence in each level of the hierarchy was determined by dividing the number of incidents representing a particular condition by the total number of incidents represented in the database (1,814).
4. The resulting hierarchy and associated probabilities for each element within the hierarchy are presented in Appendix C.

## **5.0 PRELIMINARY HAZARD ANALYSES**

### **5.1 Background**

A Preliminary Hazard Analysis (PHA) was conducted on all Coast Guard vessels based solely on the information contained in the LERAM project database mishap reports from 1989 through 1992. This analysis was conducted to determine what information could be extracted from a historical mishap database, what information would be useful to capture in such a database, and where such an analysis fell short in delivering useful information to facility managers of Coast Guard floating units.



During the technical interchange meetings held on February 15-16, 1994, at Battelle, a proposed format for the preliminary hazard analysis was developed. This PHA report format was subsequently reviewed and modified during the technical interchange meeting held on April 5, 1994, at the Coast Guard Research and Development Center. As a result of these meetings, it was agreed that a separate PHA would be constructed for each Vessel Hazard Group and that each would include the following information:

- A description of the major hazards associated with the hazard group.
- A description of the major effects associated with each hazard.
- The Hazard Level, as determined from the mishap class severity, associated with each hazard.
- The probability of occurrence associated with each hazard.
- The minimum, maximum, and average cost associated with mishaps involving each hazard.
- Comments concerning each hazard as appropriate.

An additional field in the PHA was included to allow for the addition of baseline exposure information when an appropriate source for such information becomes available. At this time, exposure information is not accurately captured in the reporting of mishaps.

## **5.2 Development of the Preliminary Hazard Analyses**

The following procedure was used to develop each PHA:

1. The mishaps associated with each hazard group were identified using the hazard list database.
2. A review was conducted of the LERAM project database for each mishap identified as part of a particular PHA. This review included a review of the narrative descriptions associated with the mishap.
3. On the basis of this review, a synthesis was made of the hazards that were common to the group. This synthesis was made to elevate the specificity of the individual hazards identified with each incident to a more usable level of analysis. Each synthesis was then entered into the PHA as a hazard. For example, hazards related to slippery decks might have included hazards such as ice, snow, water, fuel, and soap.
4. Based on the results of mishaps associated with each PHA hazard, a short statement was developed to describe the results of not controlling the hazard. This statement also included the analysts' best estimates of possible results not presently represented in the mishap experience of the Coast Guard.
5. The LERAM information on Accident Severity Level for each mishap associated with a PHA hazard was entered into the Hazard Level column of the PHA as an indication of the relative and gross severity of each PHA hazard.

6. The number of mishaps associated with the PHA hazard was then used to determine the likelihood of occurrence. This likelihood was determined by dividing the number of mishaps associated with each PHA hazard by the total number of mishaps in the Coast Guard Vessel Systems Hazard List (1814).
7. The minimum, maximum, and average costs associated with each hazard were determined from information provided by the LERAM project database on each mishap.
8. Since many mishaps involved more than one hazard group, they may appear on more than one PHA. To provide a record of the interactions between PHAs, a separate listing of the associated hazard groups and corresponding mishap numbers was developed. This listing appears at the beginning of Appendix D.
9. After each PHA was completed, it was reviewed by at least one other analyst to insure continuity in the synthesis.
10. The resulting PHAs for each hazard group are presented in Appendix D.

## **6.0 VESSEL HAZARD MATRIX**

### **6.1 Background**

A Vessel Hazard Matrix was developed to illustrate the correlation between hazards and risks to operating systems, engineering systems, management systems, and the environment.

During the technical interchange meeting held on April 5, 1994, at the Coast Guard Research and Development Center, it was determined that a matrix that would include all hazards identified during the course of the project would be excessively cumbersome and of little practical value. It was also determined that there would be little in the way of empirical data upon which to base a correlation between hazards and the systems involved. As a result, it was agreed that the hazard matrix would include only the analysts' best judgment of whether or not a particular hazard group was a risk to the operating systems, engineering systems, management systems, or the environment.

### **6.2 Development of the Vessel Hazard Matrix**

All hazards discovered during the PHA and previous analyses were considered. The likely interactions between Coast Guard systems and the hazard groups were determined, based on the analysis of the LERAM project database and the previous tasks of this project. Table 2 gives a simplified definition of these systems.

**Table 2. Coast Guard System Definitions.**

<b>SYSTEMS</b>	<b>DEFINITION</b>
CG Operations Systems	Systems necessary for mission accomplishment
CG Engineering Systems	Vessel's mechanical systems (also includes electrical, hydraulic, pneumatic, etc.)
CG Management Systems	Anything directly involving personnel or personnel issues
Environment	External, natural environment (primarily water and air)

To develop the Vessel Hazard Matrix, a group of three analysts, each of whom was significantly involved in the development of the Vessel Hazard List and Preliminary Hazard Analyses, reviewed each hazard group in relation to its known or expected impact on the three Coast Guard systems and the environment. Based on their detailed knowledge of the mishaps representing each hazard group and the consequences of the mishaps, the analysts used the following criteria to identify relationships in the matrix:

- If mishaps representing a hazard group would typically result in degradation of one of the above types of systems, it was considered a primary hazard.
- If mishaps representing a hazard group might indirectly result in the degradation of one of the above types of systems, it was considered a secondary hazard.
- If mishaps representing a hazard group were to have little influence on the performance of one of the above types of systems, it was considered to be an inconsequential risk.

The Vessel Hazard Matrix is presented in Appendix E.

## **7.0 RECOMMENDATIONS**

### **7.1 Background**

The primary purpose of this project was to use a mishap database approach to evaluate how effective a preliminary hazard analysis would be. Although in the preliminary stages, the characterization of hazards from reported mishaps might assist facility managers identify risk control strategies to increase safety on Coast Guard vessels. The results indicate that examining historical information gathered in a mishap database, it is possible to identify and coarsely characterize hazards that relate to operational, engineering, managerial, and environmental systems. Facility managers, armed with a coarse characterization of the hazards associated with their vessels, can more easily generate a set of strategies and recommendations which would reduce risk to an acceptable level while minimizing costs to the Coast Guard.

## **7.2 Advantages and Disadvantages of the Database Approach**

Although most hazard analysis projects tend to use a more traditional safety analysis, in some instances, the database approach to hazard identification might be a viable alternative. A traditional engineering system analysis requires extensive resources which includes both personnel and time to thoroughly familiarize oneself with the system, observe the various phases of operations, and identify the potential sources of hazards based on the procedures used, operations to be performed, and existing systems and technologies available to the personnel.

On the other hand, a database analysis could be much faster and much less expensive than the traditional engineering approach as it involves mainly looking at a database and interpreting/analyzing the information contained in it, provided the accident database is sufficiently detailed to support such analysis. Even in support of detailed traditional analysis, the database approach can substantially reduce the background investigative work. The main disadvantage associated with using an accident database approach is that the information contained in a mishap database deals with the consequences of an event rather than the causes (hazards) that contributed or generated that particular event. Except in the case of major accidents, which are usually so few in number as to be meaningless in the development of such an analysis, the mishap process seldom provides detailed information on the chain of events that led up to a mishap. It is even more difficult to identify these root hazards when the information contained in the database is several steps removed from the actual occurrence. In fact, the information contained in the database does not necessarily represent the entire set of facts, it is a subset taken from the actual pool of data collected during the investigation, which has been further reduced from the information contained in the occurrence report. As a consequence, the information contained in the database might not include information that is required or would be useful in determining what the hazards were. The result is that an analyst eventually has to review the data generated from the database PHA listing and present recommendations to the decision maker.

A database analysis will identify and summarize safety concerns that were associated with previous mishaps. However, these safety concerns might not be an accurate representation of the existing conditions at the time of the analysis, or in the future. The database, due to the fact that it is a collection of past events, may not reflect recent changes in equipment, training, procedures, or operational characteristics. These concerns are often not reflected in the information contained in the database.

## **7.3 Conclusion**

The effort involved in this project approximately represents the effort that would have been required to perform an engineering based preliminary hazard analysis on perhaps four or five Coast Guard vessels similar in size and complexity to the patrol boat class of vessels. Such an effort would have resulted in the identification of specific hazards and ways to reduce the risks associated with each hazard. Thus, the database PHA approach it has demonstrated an efficiency advantage.

The results of this effort have been the identification and characterization of general hazards across the entire Coast Guard fleet of vessels. The hazards have been rank ordered in terms of severity and cost, permitting facility managers to prioritize their risk reduction efforts. The resulting PHA's and hazard lists effectively define and characterize vessel hazards. This presentation may be ordered by vessel class, cost, severity, or some other parameter deemed important by management. The important result is that the database approach PHA provides the foundation and background necessary for an analyst to quickly analyze a particular hazard and recommend effective controls, thus saving the Coast Guard time and money.

## 8.0 REFERENCES

1. Romberg, B.H., Ryley, L.C., and Wolverton, C.D. (1993). An Analysis of Coast Guard Vessel Mishaps (FY1984-FY1992). Technical Report. CompuCon. Haddam, CT.
2. Lambert, H.E. (1973). Systems Safety Analysis and Fault Tree Analysis. Lawrence Livermore Laboratory Technical Report No. UCID-16238, University of California, Livermore, California.
3. Malaski, S.W. (1982). System Safety: Technology and Application. Garland STPM Press, New York.
4. Hammer, W. (1972). Handbook of System and Product Safety. Prentice-Hall, New York.
5. Hammer, W. (1989). Occupational Safety Management and Engineering (4th ed.). Prentice Hall, NJ.
6. Horodniceanu, M., Cantilli, E.J., Shooman, M., and Pignataro, L.J. (1976). Transportation System Safety Methodology. Polytechnic Institute of New York Technical Report No. TR-76-505, Brooklyn, NY.
7. Cheaney, E.S, and Coyle, A.J. (1977). System Safety Analysis of a Commercial Vessel. Battelle Columbus Laboratories Technical Report No. CG-D-39-77. Columbus, Ohio.
8. Transportation Safety Board of Canada (1991). Accident Investigation Manual: Human Performance Chapter. Transportation Safety Board of Canada, Montreal, Quebec.

## **APPENDIX A**

### **Coast Guard Vessel Hazard Definition:**

#### **Coast Guard Vessel System Hazard Groups**

This appendix contains the descriptions of the Hazard Groups proposed for use by the Coast Guard's vessel safety organization. Hazard Groups are meant to provide a convenient way to coarsely organize vessel hazards. Grouping improves safety analysis of similar items and broadens the application of controls to multiple hazards with similar characteristics. The hazard groupings proposed represent a combination of existing hazard group taxonomies as well as hazards identified in the Coast Guard's mishap database.

The name of the hazard group is given followed by a description of hazards that should be included under the given title. These names are not unique and the user of these groupings should feel at liberty to modify the group names, descriptions, and even the number of groups to meet the safety needs of the Coast Guard. One suggestion is that safety professionals assign hazards identified in mishap reports to the hazard groups provided. This will eliminate confusion over the definition of hazard groups and reduce the reporting burden of units involved in mishaps.

## UNITED STATES COAST GUARD VESSEL HAZARD GROUPS

GROUP	DEFINITION
Armaments and Military Explosives	This hazard group includes all military armaments such as firearms, cannon, flare pistols, and explosives such as grenades, TNT and plastic explosives. These devices are intended, by their design, to inflict damage or injury. They are therefore always considered a hazard. The hazards in this group may result in either damage to equipment or injury to individuals.
Burns	Burns represent a type of injury to personnel resulting from exposure to a heat source. The result of this type of hazard is damage to the skin, internal organs or eyes as a result of the heat alone.
Capsize	This hazard is unique to vessels and involves the permanent or temporary change in the vessel's attitude in the water from design parameters. For purposes of this hazard group the capsize need not be complete so long as the final resting aptitude of the vessel exceeds it's design conditions to the point where the mission can not be carried out. A capsize hazard is also considered if the vessel proceeds through the point of inverse stability and returns to an upright position, i.e., performs a complete roll, if the change in attitude could be expected to either cause damage or injury or exceeds the design of the vessel.
Collision with Object	This hazard includes all unintentional contact by the vessel with floating or fixed objects other than other vessels (see Collision with vessel) or the sea or riverbed (see Grounding).
Collision with Vessel	This hazard includes all unintentional contact by the vessel with another vessel. Since Coast Guard vessels are involved on a daily basis with boarding and other evolutions that involve intentional contact between vessels the basis of the hazard in these cases is reflected in the amount of control exercised or available during the evolution.
Contamination	This hazard includes all instances where incompatible substances are mixed, and the result of the mixing could cause system degradation or failure. Contamination is primarily a system hazard as personnel injuries are usually more appropriately considered as toxic hazards.

**UNITED STATES COAST GUARD VESSEL HAZARD GROUPS**  
(Continued)

GROUP	DEFINITION
Electrical	This hazard is the result of unintended contact with sources of artificial or natural electricity. The electrical hazard is a result on the contact with a live circuit that could result in either damage to equipment, disruption of normal equipment function, or injury to individuals. An electrical hazard is determined by the relationship between the amount and type of current present and the equipment or individual that might be damaged. Thus for example a very low voltage source might not be a hazard to an individual but would be to sensitive electronic equipment.
Environmental Conditions	Environmental conditions which could cause damage to equipment or injury to individuals are considered a hazard. For purposes of discrimination environmental conditions are those generally surrounding the equipment or individual. The normal modes of environmental hazards are heat and cold, excessive or insufficient humidity, ice (if generalized such as icing of the topsides of a vessel as opposed to a limited area of ice on the deck), sea state, and wind.
Equipment Failure	Hazards resulting from failure of equipment to perform it's intended function properly (for mechanical failures of components see Structural Failure).
Ergonomic	Ergonomic hazards are associated with injuries to personnel sustained as a result of inappropriate body motion or actions. The primary cause of the injury is parts of the body working against itself and exceeding the skeletal, or muscular system limits of the body.
Explosion	Explosive hazards are those resulting from a rapid release of energy other than mechanical energy (see Mechanical). Hazards in this group would include both rapid combustion of materials and sudden release of pressurized equipment.
Fire	Fire hazards are those resulting from the combustion of flammable materials. Damage of injury resulting from fire hazards is usually associated with the heat generated in the process of combustion.



**UNITED STATES COAST GUARD VESSEL HAZARD GROUPS**  
(Continued)

GROUP	DEFINITION
Flooding/Sinking	Flooding and sinking hazards are unique to vessels. They include all hazards that would result enough water entering the vessel to prevent the vessel from performing it's assigned mission or in the extreme case may result in the vessel becoming completely submerged.
Grounding	Grounding are a unique hazard group to vessels and involve all hazards that result in the vessel colliding with or resting on the bottom, where such grounding is unintentional and prevents the vessel from performing it's assigned mission.
Impact and Shock	This hazard group involves all hazards in which damage or injury could be cause by the transfer of energy from on object to another. The source of the energy may be propulsive or it may be the result of gravity.
Leakage	This hazard group includes all hazards that would allow a fluid breach barrier designed to contain the fluid. This would include barriers designed to keep fluids in, e.g., tanks, and those designed to keep fluids out, e.g., hull plating.
Loss of Power or Control	This hazard group is unique to vessels includes all hazards which reduce or eliminate vessel maneuvering. The most notable hazards in this group are those related to the loss of propulsion and the loss of steering control.
Mechanical	This hazard group includes hazards which could result in damage or injury as a result of unintentional contact with properly operating, mechanical components. The damage or injury results from the unintended transfer of energy from the mechanical device to an individual or piece of equipment.
Overboard	This hazard is unique to vessels and other structures operating in the water. The hazards associated primarily result in personnel injury that may include injuries to the body as a result of the fall from the vessel, environmental injury as a result of exposure to cold water, or even death as a result of drowning.

**UNITED STATES COAST GUARD VESSEL HAZARD GROUPS**  
(Continued)

<b>GROUP</b>	<b>DEFINITION</b>
Radiation	This hazard group includes all non-thermal hazards (see Burns, and Temperature Contact) which could result in damage or injury caused by the unintentional transfer of electromagnetic, ionizing, or light (Ultraviolet and Laser) from a source to an individual or piece of equipment.
Structural Failure	This hazard group involves all failures of physical structures and assemblies such that the structure no longer performs its function. Structural failure may result in either damage or injury.
Temperature Contact	This hazard group includes hazards which could result in damage or injury as a result of direct contact with extremely hot or cold components or structures. (For non-contact hazards see Burns, Environmental, or Radiation).
Toxicity	This hazard group is primarily concerned with personnel injury and consists of hazards resulting from exposure to relatively small amounts of a substance which will result in physiological damage or loss of function. Included in toxicity is the lack of oxygen as is found in voids.
Vibration and Noise	This hazard group includes hazards which could result in damage or injury as a result of excessive reciprocal or alternating accelerations, i.e., vibration, or excessive sound pressure, i.e., noise.

## **APPENDIX B**

### **Coast Guard Vessel Hazard Definition:**

#### **Coast Guard Vessel System Hazard Listing**

This appendix contains a rather lengthy listing of vessel hazards, organized by mishap number. The mishap number corresponds to mishaps contained in the LERAM Project database. The LERAM Project database is an enhanced version of the Coast Guard's Mishap Reporting System (MISREPS) database for the time period FY1989 through and including FY1992.

For each mishap number, up to three hazard groups are cited that correspond to hazards identified by safety professional in the analysis of that mishap. In addition, up to six hazards associated with the mishap, and fitting one of the three hazard groups, are briefly described. For more detailed descriptions of the hazards, one is encouraged to examine the Preliminary Hazard Analysis (PHA) listing provided in Appendix D. Where possible, an effect of the hazards is presented in the final column.

This hazard listing serves as the foundation for the Preliminary Hazard Analysis and crudely illustrates the multidimensional aspect of mishaps. As mishap reports are designed to provide a description of the mishap, one must expend considerable effort to analyze these reports to identify the root causes and hazards associated with the mishap. This "extra effort" is paramount to a preventative safety program, for without knowledge of vessel hazards, one can do little to prevent those hazards from manifesting into mishaps.

This hazard listing presented in this appendix is also available in EXCEL 4.0 for DOS computers.

Coast Guard Vessel System Hazard Listing.

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
1	Fire	Electrical	Equipment Failure	fire	electrical short					Damage (engine room blower)
2	Ergonomic			improper body motion						Injury (knee)
3	Electrical			electrical shock	improper maintenance	electrical panel	live electrical circuit			Injury (electrocution)
4	Toxicity			insufficient atmosphere	improper maintenance					Injury (head)
5	Ergonomic	Impact/Shock		fall	ladder	carrying object				Injury (leg)
6	Impact/Shock			pinch hazard	improper maintenance					Injury (hand)
7	Impact/Shock			improper boarding						Unknown
8	Collision w/Object			submerged object						Unknown
9	Toxicity	Fire	Equipment Failure	smoke	fire		loss of power			Damage (turbocharger)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
10	Impact/Shock			overhead object						Injury (head)
11	Impact/Shock			crushing	buoy maintenance					Injury (hand)
12	Mechanical			spring loaded device	improper handling					Injury (face)
13	Toxicity			toxic substance-- iodine	flying substance					Injury (eye)
14	Ergonomic			improper lifting						Injury (back)
15	Impact/Shock			fall	ladder	carrying object				Injury (hand)
16	Impact/Shock			fall	carrying object	lack of light	misjudged step			Injury (leg)
17	Environment			fall	roll	getting out of seat				Unknown
18	Environment			wave action	fall	ladder	sharp edge			Injury (hand)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
19	Impact/Shock			obstruction on deck						Injury (ankle)
20	Mechanical	Impact/Shock		abrasion	improper maintenance	grinder				Injury (hand)
21	Fire	Mechanical		fire	flammable cloth	sparks from grinder				Unknown
22	Collision w/Vessel	Environment		wave action	improper operations					Damage (hull, topsides)
23	Impact/Shock			falling object (hatch)	ladder (ascending)	latch failure				Injury (hand)
24	Impact/Shock			pinch hazard	buoy handling	deck obstruction				Injury (hand)
25	Mechanical	Impact/Shock		sharp object (screw driver)	puncture	improper maintenance				Injury (hand)
26	Mechanical	Impact/Shock		knife	cut					Injury (hand)
27	Impact/Shock			protruding object-access panel						Injury (shoulder)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
29	Impact/Shock			ladder (descending)	fall	sharp object (hatch rim)				Injury (knee)
30	Ergonomic			lifting-improper technique						Injury (back)
31	Impact/Shock			fall	improper maintenance	open deck plates				Injury (unknown)
32	Collision w/Object			sharp object-tear hazard on pier	training	improper control maneuver				Damage (spoonson)
33	Impact/Shock		Mechanical	Improper maintenance-- used pipe for crowbar	flying object					Unknown
34	Impact/Shock			puncture	power drill					Injury (arm)
36	Impact/Shock		Ergonomic	submerged object-rock	trip hazard	improper boarding				Injury (leg)
37	Impact/Shock		Toxicity	welding slag	working overhead	falling object (slag)	Inadequate protective equipment			Injury (eye)
38	Environment		Mechanical	crushing	improper boarding wave action					Injury (hand)

**Coast Guard Vessel System Hazard Listing**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
39	Impact/Shock			carrying heavy object	improper handling					Injury (knee)
40	Ergonomic	Impact/Shock		improper motion						Injury (foot)
41	Impact/Shock			hoisting operation	improper operations	strike	pinch hazard			Injury (hand)
42	Collision w/Object			log						Damage (prop)
43	Armaments			pistol	clearing operation	firing				Unknown
44	Impact/Shock			fall	loose sand on deck					Injury (foot)
45	Impact/Shock			fall	Slippery deck					Injury (arm)
46	Impact/Shock			fall	Slippery deck					Injury (head)
47	Electrical	Fire		electrical short	fire	improper maintenance				Damage (electrical panel)



**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
48	Collision w/Object			submerged object	log					Damage (prop)
49	Fire	Toxicity	Temperature	hot object-molten slag	smoke					None
50	Impact/Shock	Environment		wave action	towing operation	line handling				Injury (unknown)
51	Impact/Shock			pinch hazard	improper maintenance					Injury (hand)
52	Impact/Shock			pinch hazard	poor footing					Injury (hand)
53	Impact/Shock			edge-refrigerator door lip						Injury (hand)
54	Environment	Impact/Shock		waves	wind	exposed lookout				Injury (eye)
55	Collision w/Vessel			mooring operations						Damage (deck, frames)
56	Collision w/Vessel	Loss of Power/Control	Grounding	mooring operations	emergency engine shutdown	rocks				Damage (hull)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
57	Impact/Shock			small boat launching operations	boat trailer	improper procedure				Damage (prop. engine mount)
58	Environment	Impact/Shock		wave action	small boat lowering/lifting operation					Injury (hand)
59	Environment	Impact/Shock	Structural Failure	wave action	improper stowage	storage locker door	self-launching liferaft			Damage (unknown)
60	Environment	Impact/Shock		wave action	improper temporary storage					Injury (ankle)
61	Impact/Shock	Mechanical		sharp edge	wrench slipped					Injury (hand)
62	Impact/Shock	Mechanical		cutting metal	sharp edge	improper procedure				Injury (wrist)
63	Environment	Overboard		wave action	improper boarding					None
64	Toxicity	Burns		chemical burn	battery acid	battery hydrometer				Injury (eye)
65	Collision w/Vessel	Impact/Shock		improper lookout						Damage (unknown)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
66	Ergonomic			hoisting operation	boat davit wrench					Injury (groin)
67	Impact/Shock			falling object-- hatch cover grate						Injury (foot)
68	Equipment Failure	Impact/Shock		hoisting operation	improper maintenance	worn cable				Injury (hand)
69	Loss of Power/ Control	Capsize	Environment	engine shutdown	wave action	overboard				Unknown
70	Fire	Toxicity		smoke						Damage (Smoke, water, burning)
71	Impact/Shock			protruding object						Injury (chin)
72	Impact/Shock			overhead object-- basket lifted in helicopter operation						Damage (antenna)
73	Armaments			pistol	clearing operation	improper procedure	fired round			None
74	Impact/Shock	Toxicity		roll	toxic substance-- descaler	flying object-- descaler				Injury (eye)

**Coast Guard Vessel System Hazard Listing-**  
**(Continued)**

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS								EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	HAZARD 7	HAZARD 8	
75	Impact/Shock	Structural Failure	Environment	pinch hazard	dock sections	broken chain	wind	mooring operations	line handling			Injury (hand)
76	Impact/Shock			cut	line spool	improper procedure						Injury (hand)
77	Contamination			hammering on metal	rust	improper procedure						Injury (eye)
78	Armaments			improper procedure--didn't remove clip	unauthorized use	unsecured weapon--left in cabin						discharged weapon
79	Impact/Shock			fall	suspended object--buoy							Unknown
80	Impact/Shock			fall	improper motion	General Quarters operations						Injury (knee)
81	Environment	Impact/Shock		wave action	protruding object--cabin							Injury (leg)
82	Ergonomic	Environment		fall	ice							Injury (back)
83	Impact/Shock			pinch hazard	lifting gear	improper procedure						Injury (hand)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
84	Environment	Impact/Shock		wave action	ladder	fall				Injury (hand)
85	Electrical	Environment	Fire	conductive material-water	short circuit-grill controls	wave action				Unknown
86	Radiation			radiation-arc from welding	reflective surfaces	lack of protective equipment				Injury (burns)
87	Impact/Shock			loading operations	poor footing					Unknown
88	Structural Failure	Impact/Shock		cut	knife	improper tool				Injury (hand)
89	Structural Failure	Impact/Shock		gasket blew	flammable material	loss of power				Unknown
90	Fire			fire	oil soaked lagging					Damage (engine lagging)
91	Fire	Burns		fire	welding/flame cutting operation					Injury (hand, face)
92	Contamination			toxic material-antifreeze	petcock design location					Injury (eye)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
94	Impact/Shock			material handling	winch operations	flying object (chain)				Injury (head)
95	Mechanical	Impact/Shock		cut	knife					Injury (hand)
96	Impact/Shock			mooring operations	line handling	pinch				Injury (hand)
97	Impact/Shock			SAR operations	line handling	grapnel				Injury (knee)
98	Mechanical			exposed turning shaft	training drill	human error				Injury (arm)
99	Mechanical	Impact/Shock		grinding operation	abrasion					Injury (hand)
100	Mechanical	Impact/Shock		hand slipped	pocket knife	gasket removal				Injury (hand)
101	Collision w/Object	Loss of Power/ Control		submerged object						Damage (fouled prop)
102	Impact/Shock			ladder	fall					Injury (unknown)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

NLSHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
103	Impact/Shock			overhead object	falling object					Injury (forehead)
104	Fire	Toxicity		fire in motor room	smoke--inhalation					Injury (respiratory)
105	Mechanical	Impact/Shock		knife	stripping wire insulation	cut				Injury (hand)
106	Impact/Shock	Environment		wave action	slippery surface-- wet deck	fall				Injury (leg)
107	Environment	Impact/Shock		wave action	vessel motion					Injury (leg)
108	Impact/Shock			crossbar slid back	deck hatch					Injury (hand)
109	Mechanical	Impact/Shock		sharp edge	working aloft	ceiling fan				Injury (cheek)
110	Impact/Shock	Mechanical		razor knife	cut					Injury (hand)
111	Impact/Shock			unsecured object pivoted--boat shoe						Unknown

Coast Guard Vessel System Hazard Listing.  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
113	Impact/Shock			wet deck	Improper maintenance					Injury (head)
116	Mechanical	Impact/Shock		sharp edge-razor blade	scraping-blade slipped					Injury (hand)
117	Collision w/Object			submerged object						Damage (prop, shaft)
118	Impact/Shock			pinch hazard	towing operation					Injury (hand)
119	Collision w/Object			helicopter too close	helicopter operations	lack of attention (to helo's position)				None
120	Mechanical			power saw	failure to use guard					Injury (hand)
122	Impact/Shock			line slipped	other vessel rolled					Injury (hand)
123	Environment			Engine Room	heat					Injury (heat exhaustion)
124	Impact/Shock			blocked vision	improper position					Unknown



**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS								EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	HAZARD 7	HAZARD 8	
126	Mechanical			lack of protective equipment	hitting hard object with axe							Injury (eye)
127	Impact/Shock			overhead object								Injury (head)
128	Structural Failure	Impact/Shock		material handling	falling object	ladder	handle broke					Injury (hand)
129	Impact/Shock			slippery surface	sharp object-lifting bail							Injury (hand)
130	Impact/Shock	Explosion		overhead object	falling object-light tube	exploding object	glass & gas particles					Injury (unknown)
131	Impact/Shock			sharp edge								Injury (hand)
132	Impact/Shock			fall	carrying object							Injury (head)
133	Impact/Shock			hatch	sharp edge							Injury (head)
134	Impact/Shock			radar mast in lowered position	sharp edge							Injury (head)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
135	Overboard			Improper boarding	line handling	fall				Injury (knee)
136	Impact/Shock	Loss of Power/ Control	Environment	wake created by other vessels	relatively high speed around piers	improper body motion				Injury (groin)
137	Fire	Burns		flammable material—gasoline	reignition & reflash	Improper training procedure				Injury (back)
138	Ergonomic	Impact/Shock		fall	working in confined space	poor footing				Injury (ankle)
139	Environment	Ergonomic		wave action	vessel motion	improper body motion				Injury (back)
140	Collision w/Vessel			SAR operations	boarding					Damage (antenna)
141	Impact/Shock			ladder (descending)						Injury (foot)
142	Impact/Shock			falling object	unsecured object					Injury (hand)
143	Environment	Overboard		slippery deck	ice					Injury (foot)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
144	Overboard			fall	improper maintenance					Injury (shoulder)
145	Impact/Shock			fall	poor footing	poor equipment stowage				Damage (handheld radio)
146	Mechanical			pinch hazard						Injury (hand)
147	Impact/Shock			hand slipped	sharp edge					Injury (hand)
148	Grounding			navigation in restricted waters						Unknown
149	Impact/Shock			improper boarding	loading operations					Injury (knee)
150	Mechanical			sharp edge						Injury (head)
151	Impact/Shock			wave action	high speed operations	vessel motion				Injury (ankle)
152	Collision w/Vessel			other vessel turned sharply	near other vessels					Damage (near bow?)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
153	Impact/Shock			ladder						Injury (back)
154	Impact/Shock	Environment		pinch hazard	improper stowage of gear	wave action				Injury (knee)
155	Impact/Shock			pinch hazard	buoy handling	deck obstruction				Injury (hand)
156	Loss of Power/ Control	Equipment Failure	Environment	lack of power	improper position- -bow not into sea	wave action				Damage (oar & pump)
157	Structural Failure	Impact/Shock		unsecured object- hook failed	falling object					Injury (ankle)
158	Temperature			improper operation	error prone design					Damage (pump seals)
159	Collision w/Vessel	Environment		towing operations	wide tow	wind				Damage (hull)
161	Collision w/Object			improper line handling						Damage (fouled prop)
162	Impact/Shock			fall	open deck hatch					Unknown

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
163	Impact/Shock			overhead object	improper motion— jumped					Injury (head)
164	Fire	Contamination		fire	gasoline					Injury (burn)
165	Impact/Shock			pinch hazard	buoy handling	deck obstruction				Injury (hand)
166	Leakage	Equipment Failure	Toxicity	smoke	oil	loss of power	improper maintenance			Unknown
167	Structural Failure	Impact/Shock		falling object— window	unsecured object— latch slipped					Injury (hand)
168	Impact/Shock			improper motion						Injury (ankle)
169	Structural Failure	Leakage	Fire	failed seal	oil leak	increased speed— increased exhaust temp.	improper maintenance			Damage (lagging)
170	Impact/Shock			overhead object	improper procedure					Injury (head)
171	Collision w/Vessel			other vessel close wave action						Damage (hull)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

HISAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
173	Impact/Shock			Improper operation						Injury (head)
174	Fire			flames near engine	high temperature					Damage (unknown)
175	Impact/Shock			boom retracted all the way						Unknown
176	Impact/Shock			fall	ladder (descending)					Injury (hand)
177	Mechanical		Impact/Shock	grinding operation						Injury (knee)
178	Impact/Shock			small boat launching operations	moving object-trailer winch	improper operation				Injury (hand)
179	Impact/Shock			pinch hazard	buoy handling	deck obstruction				Injury (hand)
180	Contamination			welding/flame cutting operation	overhead work	melted aluminum				Injury (eye)
181	Impact/Shock			fall	ladder (descending)					Injury (hand)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
182	Toxicity			toxic fumes-oil spill						Injury (respiratory)
183	Toxicity			open fuel oil coalescer	high pressure cylinder	fuel				Injury (eye)
184	Impact/Shock			sharp object--metal bar						Injury (back)
185	Impact/Shock			object on deck--tripping hazard						Injury (wrist)
186	Ergonomic			athletics	improper motion					Injury (ankle)
187	Structural Failure			open hanger door						Damage (hanger door)
188	Collision w/Object			submerged object--buoy & anchor system						Damage (prop & shaft)
189	Collision w/Object	Overboard		buoy maintenance	crush	fall				Injury (leg)
190	Impact/Shock	Environment		water filler leaking	roll					Injury (leg, knee)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

HISAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
191	Impact/Shock			vessel motion	"pinch point"- towline & taffrail					Injury (rib)
192	Collision w/Vessel	Environment		wind	mooring operation					Damage (deck appendages); other vessel damage to transom & nets
193	Impact/Shock	Mechanical		grinding metal	airborne material	inadequate protective equipment				Injury (eye)
194	Impact/Shock			buoy maintenance	flying object-chain stopper recoiled					Injury (leg)
196	Grounding	Environment		propeller wash from another vessel	wave action	object in/near water-bridge	passing through locks			Unknown
197	Structural Failure	Impact/Shock	Electrical	object fell	electric current	improper maintenance				Injury (electrocution)
198	Impact/Shock			sledge pounding plug	holding plug					Injury (hand)
199	Electrical	Leakage		working in confined space	improper procedure-- wearing metal watch band	exposed electrical lead				Injury (wrist)
201	Impact/Shock			overhead object-- hatch cover	improper maintenance--no safety tape					Injury (head)



**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
202	Electrical			120 vac electrical power	electrical short to lifeline					Injury (electrocution)
203	Collision w/Vessel			near other vessel						Damage (hull); Injury (unknown)
204	Contamination			working overhead	flying substance--dust	improper procedure--lack of protective equipment				Injury (eye)
205	Impact/Shock			obstacle on deck	improper procedure--leaving personal items on deck	improper body motion				Unknown
206	Loss of Power/ Control	Capsize	Grounding	engine shutdown	fuel starvation	surf zone	beach			Damage (engine)
207	Impact/Shock			vessel motion						Injury (head)
208	Impact/Shock			protruding object	sharp edge					Injury (back)
209	Overboard	Environment		towing operations	wave action	vessel motion				Unknown
210	Overboard	Impact/Shock	Structural Failure	wave action	lifeline failure					None

Coast Guard Vessel System Hazard Listing.  
(Continued)

WISAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
211	Structural Failure			line parted	towing operation					Damage (line)
212	Mechanical			pinch point-- spring coils						Injury (arm)
213	Impact/Shock	Environment		edge--door	unsecured object	vessel motion				Injury (hand)
215	Impact/Shock			suspended object moved	"pinch" area					Injury (hand)
216	Impact/Shock			boarding	slip hazard					Injury (hand)
217	Capsize	Overboard		improper loading of vessel						Damage (engine)
218	Mechanical			moving parts-- turning coupling						None
219	Mechanical	Impact/Shock		spring-loaded part						Injury (face)
220	Impact/Shock			fall	improper boarding	carrying object				Unknown

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
222	Environment	Impact/Shock		wave over bow	fall	obstruction				Injury (arm)
223	Structural Failure	Impact/Shock		deteriorated dock	fall					Injury (knee)
224	Impact/Shock			object on deck- trip hazard	protruding object					Injury (leg)
226	Impact/Shock			sharp edge-knife						Injury (hand)
227	Explosion	Toxicity		battery maintenance	battery acid					Injury (acid burn)
228	Impact/Shock			edge-door sill						Injury (head)
229	Mechanical			engine maintenance	operating engine	flywheel				Injury (hand)
230	Impact/Shock	Structural Failure	Toxicity	improper loading	obstacle on deck	airborne material- paint				Injury (eyes)
231	Mechanical	Impact/Shock		maintenance operations	improper tool	knife	cut			Injury (hand)

Coast Guard Vessel System Hazard Listing.  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
232	Environment	Impact/Shock		wind	hatch improperly secured					injury (hand)
233	Environment	Impact/Shock		tidal surge	object in water- bridge support					Damage (antenna)
234	Environment	Impact/Shock		SAR operations	wave action					Injury (hand)
235	Toxicity			improper maintenance	gasoline transfer					Injury (eye)
236	Grounding	Loss of Power/ Control		rocks	mooring operation	equipment failure	loss of control			Damage (prop)
237	Impact/Shock			edge-of hatch	hatch improperly secured					Injury (hand)
238	Grounding			rocks						Damage (prop)
239	Fire			fire						Unknown
240	Impact/Shock			helicopter operations	hoist operations	entanglement				Damage (antenna)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 8	
241	Impact/Shock	Contamination		maintenance operations	corrosion					Injury (eye)
242	Structural Failure	Temperature	Toxicity	improper maintenance	unsecured object- -wires	hot turbocharger	smoke	loss of power		Damage (battery, wiring)
243	Impact/Shock			obstruction on deck	fall					Injury (ankle)
244	Toxicity	Impact/Shock		toxic material- battery liquid	airborne material					Injury (eye)
245	Radiation			maintenance operations	welding/flame cutting operation					Injury (eye)
246	Impact/Shock			edge & pinch point	moving object- hatch	improper procedure				Injury (hand)
247	Impact/Shock			fall	ladder (descending)	improper personal equipment				Injury (unknown)
248	Equipment Failure	Mechanical		helicopter operations	hoist operations	entanglement				Unknown
249	Impact/Shock			object on bulkhead						Injury (groin)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS								EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 8			
250	Fire	Loss of Power/ Control		fire	emergency engine shutdown						Damage (unknown)	
251	Contamination			airborne material	moving air	lack of protective equipment					Injury (eye)	
252	Impact/Shock			sharp object	improper stowage						Injury (hand)	
253	Collision w/Object			floating object	emergency engine shutdown						Damage (engine)	
255	Burns	Structural Failure	Loss of Power/ Control	hot substance-- Overheated lubricating oil	airborne substance--oil	oil seal blew out	emergency engine shutdown				Injury (face); Damage (loss of power)	
256	Contamination			grinding operation	maintenance operation	airborne debris					Injury (eye)	
258	Impact/Shock	Toxicity		overhead operation--brazing substance	airborne substance						Injury (eye)	
259	Impact/Shock			improper maintenance	stored energy in spring	flying object					Injury (face)	
260	Impact/Shock			unsecured objects							Injury (head)	

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
261	Impact/Shock	Mechanical		stuck valve	edge					Injury (hand)
263	Environment			rough weather						Damage (engine)
265	Impact/Shock			buoy maintenance	deck obstruction	improper procedure				Injury (leg)
267	Impact/Shock			lost balance	hard surface-deck					Injury (shoulder)
269	Grounding			rocks	channel entry	navigation error				Unknown
270	Impact/Shock			pinch hazard	line handling					Injury (hand)
273	Impact/Shock			wave action						Injury (head)
274	Impact/Shock			ladder	sharp object - safety chain padeye	improper ladder use	carrying object in both arms			Injury (back)
276	Impact/Shock			slippery deck	improper boarding					Injury (hip)

Coast Guard Vessel System Hazard Listing.  
(Continued)

HISAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
277	Environment	Overboard		wave action	improper boarding fall					Unknown
278	Loss of Power/ Control			emergency engine shutdown	smoke	flammable material-Engine lagging				Unknown
279	Overboard	Impact/Shock		slippery deck-- soap	hard object-- concrete sea wall					Unknown
280	Toxicity			training (OBA)	lack of oxygen					Injury (head)
281	Environment	Impact/Shock		wave action	ladder (descending)	hatch improperly secured				Injury (hand)
282	Grounding	Impact/Shock		rocks						Injury (head); Injury (face)
283	Ergonomic	Impact/Shock		ships maneuvering	improper motion					Injury (knee)
284	Impact/Shock			slippery surface-- wet hatch rim						Injury (elbow)
285	Structural Failure	Mechanical		maintenance	moving object					Injury (hand)



**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS				IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3		HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
286	Impact/Shock				fall	poor footing	trailer loading operations				Injury (head)
288	Burns	Environment			hot material—cigarette ash	wind	airborne material				Injury (eye)
289	Explosion	Toxicity			battery gases	battery acid					Damage (battery)
291	Grounding				ground	navigation error					Damage (prop)
292	Ergonomic				improper lifting						Injury (back)
293	Impact/Shock	Structural Failure			worn line	improper boarding	fall	working on scaffolding			Injury (unknown)
294	Collision w/Object				submerged object						Damage (prop, shaft, keg)
295	Contamination				maintenance operations	grinding dust					Injury (eye)
296	Impact/Shock				Helicopter operations	hoist operations	falling object	rescue basket			Injury (hand)

**Coast Guard Vessel System Hazard Listing  
(Continued)**

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
297	Mechanical	Impact/Shock		maintenance operations	wrench slipped					Injury (face)
298	Burns			Chemical burn	improper procedure--OBA use	fire drill				Injury (eye)
300	Contamination			metal particles	sweeping up shavings					Injury (back)
301	Grounding			bad navigation chart	bar					Damage (outdrive)
302	Impact/Shock			stowing hose in rack	pinch					Injury (hand)
303	Impact/Shock			pinch hazard	improper maintenance	wearing ring				Injury (hand)
304	Structural Failure	Impact/Shock		improper maintenance--rotten stop parted	flying object--hawser straightened					Injury (face)
305	Structural Failure	Impact/Shock		helicopter operations	flying object--parted line					Injury (hand)
306	Impact/Shock			fall	object on deck					Injury (leg)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
307	Ergonomic			heavy object	improper lifting					Injury (unknown)
308	Environment	Impact/Shock		wave action	cut	sharp fitting				Injury (hand)
309	Mechanical	Equipment Failure		pinch hazard	improper maintenance	unsecured object- propeller shaft	loss of power			Injury (hand)
310	Impact/Shock			moving object- dogpins handle	strike	securing hatch				Injury (face)
311	Toxicity			material handling	detergent/degreaser	improper stowage				Injury (eye)
312	Impact/Shock			oil on deck	fall	exposed equipment				Injury (hand)
313	Impact/Shock			pinch hazard	training drill					Injury (hand)
314	Armaments	Equipment Failure		shrapnel	round exploded before being chambered					Injury (leg)
315	Overboard			fall	vessel motion	improper boarding				None

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
316	Mechanical	Impact/Shock		knife	cut					Injury (hand)
317	Impact/Shock			machete	cut					Injury (leg)
318	Fire			fire	loss of power	oil soaked lagging				Unknown
319	Mechanical			sharp edge-knife	slip hazard					Injury (leg)
321	Impact/Shock			slippery surface-- wet deck	sharp object-- metal edge of trash can					Injury (leg)
322	Impact/Shock			improper material handling						Injury (head)
323	Collision w/Object			submerged object						Damage (engine)
324	Environment			wave action	roll cage					Injury (face)
325	Ergonomic			heavy lifting	60# anchor					Injury (back)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS								EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	HAZARD 7	HAZARD 8	
326	Impact/Shock			sharp edge-- metal tag nearby								Injury (hand)
327	Structural Failure	Impact/Shock		line parted	suspended object	falling object						Injury (foot)
329	Impact/Shock	Environment		unsecured ladder	roll							Unknown
330	Structural Failure	Impact/Shock		loose metal fragments--from nozzle								Injury (leg)
331	Impact/Shock			overhead object	off wave							Injury (head)
332	Structural Failure	Impact/Shock		disconnected hose	falling object-- paint pot							Injury (ankle)
333	Collision w/Vessel			law enforcement operations								Unknown
334	Loss of Power/ Control	Grounding	Environment	engine failure	SAR operations	wave action	navigation in restricted waters					Unknown
336	Electrical			electrical shock	improper maintenance							Injury (electrocution)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
337	Impact/Shock			fall	poor footing					Injury (ankle)
339	Armaments			round discharge over side	slide stopped short					None
340	Impact/Shock	Environment		deck plate removal	wave action	pinch				Injury (hand)
342	Mechanical	Impact/Shock		cleaning knife	cut					Injury (hand)
343	Fire	Toxicity		fire (electrical)	air conditioner					Unknown
345	Structural Failure	Temperature	Impact/Shock	high pressure cylinder	valve damage	CO2 cylinder handling				Injury (leg)
347	Impact/Shock			improper landing	jumped 6'					Injury (ankle)
349	Impact/Shock	Overboard		improper boarding	slippery deck					Unknown
350	Ergonomic			improper lifting	heavy object					Injury (back)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
351	Impact/Shock	Mechanical		wave action	maintenance while underway	overhead object--control console edge	working in confined space			Injury (head)
352	Leakage	Loss of Power/Control		engine oil leak	emergency engine shutdown					Damage (turbocharger)
353	Impact/Shock			pinch hazard						Injury (foot)
354	Impact/Shock			cut	carrying object	hatch entry				Injury (leg)
355	Ergonomic			improper motion						Injury (back)
356	Impact/Shock	Overboard	Toxicity	airborne hazardous material--antifreeze						Injury (eye)
357	Impact/Shock			hatch improperly secured open						Injury (hand)
358	Impact/Shock			trip hazard	improper boarding cut		exposed cotter pin			Injury (leg)
359	Impact/Shock			fall	Poor footing					Injury (ankle)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
360	Impact/Shock	Structural Failure	Equipment Failure	wheel blew out of valve	pump malfunctioning	increased pressure--cracked valve body				Injury (hand)
362	Ergonomic	Impact/Shock		weight slipped	tried to bear weight on arm/shoulder					Injury (arm)
363	Burns			chemical burn						Injury (skin)
364	Environment	Collision w/Vessel	Overboard	wave action	navigation in restricted waters					Unknown
365	Grounding			navigation in restricted waters						None
366	Impact/Shock			pinch hazard	lifting gear	improper operation				Injury (hand)
367	Ergonomic			ladder (ascending)	improper body position					Injury (back)
368	Mechanical	Impact/Shock		turning shaft	improper operation to stop turning shaft	wrench				Injury (hand)
369	Impact/Shock			open scuttle	fall					Injury (rib)



**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 8	
370	Impact/Shock			open scuttle	fall					Injury (hand)
371	Impact/Shock			buoy maintenance	lifting operations	buoy chain				Injury (shoulder)
372	Temperature			hot substance--water						Injury (thigh)
373	Mechanical		Impact/Shock	knife slipped	removing caulking from deck plate					Injury (hand)
374	Mechanical			hatch unexpectedly closing						Injury (head)
375	Impact/Shock	Environment		wave action	(sharp object)--bailing					Injury (head)
376	Impact/Shock			fall	ladder (descending)	object on fall path				Injury (chest)
377	Impact/Shock			fall	improper maintenance					Injury (ankle)
378	Mechanical		Impact/Shock	grinding operation cut						Injury (arm)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 8	
379	Impact/Shock			trip hazard						Injury (hand)
380	Electrical	Structural Failure		electrical shock	drive belt failure					Injury (electrocution)
381	Impact/Shock			stowage operation	wave action	pinch				Injury (hand)
382	Impact/Shock	Mechanical	Contamination	grinding operation	grinding dust					Injury (eye)
383	Environment	Impact/Shock		wave action	ladder (ascending)	improper boarding				Injury (leg)
384	Environment			hot engine room						Injury (heat exhaustion)
385	Impact/Shock			fall	improper maintenance	open deck hatch				Injury (leg)
386	Structural Failure	Impact/Shock		rack support slipped						Injury (hand)
387	Impact/Shock			stairs	slip hazard					Injury (back)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
388	Armaments			backfire	flying object— shrapnel					Injury (neck)
389	Environment	Impact/Shock		wave action						Injury (hand)
390	Environment	Impact/Shock		wave action	sharp object					Injury (neck)
391	Impact/Shock			pinch hazard	mounting portable equipment					Injury (hand)
392	Collision w/Object			mooring operations	improper operating procedure					Damage (bow, pier)
393	Impact/Shock			tangled in hose	improper maintenance	fall	object on deck— bitt			Unknown
394	Impact/Shock			fall	trip hazard					Injury (knee)
395	Grounding	Environment	Impact/Shock	sand bar	wave action	fall				Injury (hand)
396	Environment	Structural Failure	Impact/Shock	wave action	slippery deck	vessel motion				Injury (knee)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
397	Grounding			navigation in restricted waters						Unknown
398	Equipment Failure	Grounding	Collision w/Object	radar failed	submerged object	navigation in restricted waters				Damage (keg)
399	Impact/Shock			fall	ladder (descending)					Injury (wrist)
400	Impact/Shock			obstruction on deck	improper maintenance					Injury (ankle)
401	Mechanical			sharp edge-shelf						Injury (head)
403	Structural Failure	Mechanical		grinding disk broke	sharp object-piece of disk	grinding operations				Injury (thigh)
404	Collision w/Object			submerged object						Unknown
405	Loss of Power/ Control	Collision w/Object	Environment	engine failure	wave action	mooring operation	wind			Damage (unknown)
406	Mechanical	Impact/Shock		bench grinder	workpiece jammed					Injury (hand)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
407	Fire			welding/flame cutting operation	flammables in area					Unknown
408	Fire			equipment testing	electrical fire					Unknown
409	Impact/Shock	Environment		"pinch" point-- between hoisting hook & boat attachment	wave action					Injury (hand)
410	Mechanical			sharp edge-- corner of tank						Injury (head)
413	Impact/Shock			working in confined space	motor maintenance	disassembly	pinch			Injury (hand)
414	Impact/Shock			slippery surface-- wet shoes	protruding object-- locker latch					Injury (elbow)
415	Ergonomic			lifting						Injury (back)
416	Environment	Impact/Shock		wave action	vessel motion	fall	standpipe			Injury (arm)
417	Impact/Shock			grinding operation	working overhead	binding of rotary tool				Injury (finger)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

NISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
418	Collision w/Object			submerged object—unknown						Damage (screw, keel)
419	Impact/Shock			unsecured hatch						Injury (head)
420	Impact/Shock	Loss of Power/ Control	Grounding	towing operations	line handling	line in water	wave action	navigation in restricted waters		Unknown
421	Toxicity	Impact/Shock		chemical burn	no eye protection	sealant				Injury (eye)
422	Impact/Shock			sharp edge— combining	lack of protective equipment					Injury (head)
423	Impact/Shock			rescue drill	pump transfer	line handling	line in water			Damage (fouled prop)
425	Impact/Shock	Mechanical		slippery deck	operating engine with cowling off	exposed flywheel				Injury (hand)
426	Overboard	Impact/Shock		protruding object— lifeline brass turnbuckle	line handling	emergency response operation				Injury (arm)
427	Equipment Failure	Impact/Shock		winch brake failure	small boat lowering/lifting operation					Damage (unknown)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
428	Environment	Impact/Shock		wave action	pinch point-door edge					Injury (hand)
429	Overboard			towing operations	equipment transfer					Unknown
430	Mechanical			scuttle secured	nut that holds handwheel					Injury (head)
431	Impact/Shock			pinch hazard	material handling	obstruction				Injury (hand)
432	Armaments			weapon discharged	clearing weapons					None
434	Impact/Shock			line handling	suspended object					Injury (hand)
435	Collision w/Object	Environment		line handling	wind	current	mooring operation			Unknown
436	Impact/Shock			carrying object	trip hazard-lip of step					Injury (elbow)
437	Impact/Shock			edge-door jam						Injury (hand)

**Coast Guard Vessel System Hazard Listing  
(Continued)**

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
438	Impact/Shock			obstruction on deck						Injury (ankle)
440	Radiation			welding/flame cutting operation	improper procedure					Injury (eye)
441	Impact/Shock	Environment		ship motion	door slammed					Injury (hand)
442	Impact/Shock			wire reinforced gasket	improper maintenance					Injury (hand)
443	Impact/Shock	Structural Failure	Toxicity	fitting broke	gasoline	maintenance in confined space				Injury (eye)
444	Collision w/Object			submerged object						Damage (shaft)
445	Impact/Shock			trip hazard	material handling					Unknown
446	Overboard			line handling	improper procedure	towing operations				Injury (knee)
447	Impact/Shock	Environment		overhead object	unsecured vent	vessel motion	lost balance			Injury (mouth)



**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS				IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3		HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
448	Impact/Shock				hatch improperly secured						Injury (hand)
449	Armaments				holstering loaded pistol						Injury (hand, neck)
450	Toxicity				paint thinner	improper maintenance	transfer of open container				Injury (eye)
452	Impact/Shock				buoy maintenance	strike	buoy chain				Injury (ankle)
453	Grounding		Flooding/Sinking		navigation in restricted waters						Damage (vessel lost); Injury (unknown)
454	Mechanical		Impact/Shock		pry bar used to align object	working in confined space					Injury (face)
456	Grounding		Impact/Shock		navigation in restricted waters	vessel motion	tried to catch self	floor closed			Injury (hand)
458	Mechanical		Impact/Shock		galley operation	cutting vegetables	knife				Injury (hand)
459	Collision w/Object				submerged object-unknown						Damage (keg)

Coast Guard Vessel System Hazard Listing.  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
460	Impact/Shock	Environment		wave action	vessel motion	fall				Injury (ankle)
461	Temperature			hot metal object	welding/flame cutting operation					Injury (hand)
462	Impact/Shock			overhead object						Injury (face)
463	Impact/Shock	Environment		lifting operation	line handling	line transfer				Injury (head)
464	Impact/Shock			fall	slippery ladder					Injury (knee)
465	Impact/Shock	Ergonomic		back against hand rail	using foot to fend off other vessel					Injury (back)
466	Impact/Shock	Environment		obstruction on deck	padeye	ice on deck				Injury (ankle)
467	Fire			fuel leak in boiler						Unknown
468	Impact/Shock			protruding object- shore tie cable						Unknown

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
469	Impact/Shock			slippery ladder	ladder (descending)					Injury (elbow)
471	Impact/Shock	Mechanical		soldering iron	object slipped					Injury (thumb)
472	Impact/Shock			swinging object—buoy counterweight	buoy maintenance	hoisting operation				Injury (knee)
473	Structural Failure	Impact/Shock		small boat lowering/lifting operation	worn or defective winch cable					Damage (unknown)
474	Structural Failure	Fire	Electrical	loose electrical wires	connecting shore tie	short				Injury (hand), damage (shore tie)
475	Impact/Shock	Structural Failure		safety latch failed	falling object	improper use of hatch				Injury (face)
476	Leakage			improper procedure	fuel in bilge	wrong valve alignment				Damage (overflowed)
477	Impact/Shock			open deck hatch	wet deck	fall				Injury (leg, head)
478	Impact/Shock			vessel motion	mooring lines					Injury (neck)

Coast Guard Vessel System Hazard Listing.  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
479	Grounding			mooring operations	navigation in restricted waters					Unknown
480	Collision w/Object			navigation in restricted waters	mooring operation					Damage (hull, pier)
481	Structural Failure	Impact/Shock		towing operations	low line failure	small boat lifting gear				Injury (hand)
483	Collision w/Object			submerged object						Damage (prop)
484	Environment			wave action	improper boarding					None
485	Environment	Impact/Shock		wave action	object on deck					Injury (knee)
487	Impact/Shock			fall	obstruction on deck	open deck plates	improper maintenance			Injury (hand)
488	Collision w/Vessel	Flooding/Sinking		vessels working close together	wave action					Damage (hull)
489	Impact/Shock			falling object-stern light assembly						Injury (hand)

Coast Guard Vessel System Hazard Listing.  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
490	Impact/Shock			fall	open scuttle					Injury (unknown)
491	Fire	Leakage	Toxicity	flammable material-oil	oil leak on engine exhaust system					Damage (lapping), Injury (respiratory)
492	Impact/Shock			stepping over a buoy	trip hazard					Injury (leg)
493	Toxicity	Leakage		improper procedure	open fuel valve	splashing material				Injury (eyes)
495	Impact/Shock	Temperature		reaching overhead	hot exhaust pipe					Injury (hand)
496	Impact/Shock			sharp edge	carrying object	falling object				Injury (hand)
497	Impact/Shock	Environment		wave action	surf operations					Damage (antenna, superstructure, paint)
499	Impact/Shock			protruding object-bolt	slippery footing					Injury (back)
501	Impact/Shock	Environment		wave action	vessel motion					Injury (arm)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
502	Fire	Loss of Power/ Control		fire	loss of propulsion					Unknown
503	Environment	Impact/Shock		wave action	surf operations					Damage (turtle)
504	Armaments			50 Cal. machine gun	delayed firing	partial extraction of round				Damage (machine gun)
505	Grounding	Environment	Leakage	navigation in restricted waters	difficult navigation	strong tidal currents and eddies				Damage (hull)
506	Impact/Shock	Toxicity		airborne materials--paint chips	chipping paint					Injury (eyes)
507	Temperature			draining hot radiator water	improper procedure-- performing task by himself	working in confined spaces				Injury (hands)
508	Structural Failure	Impact/Shock	Environment	wave action	vessel motion	improperly secured deck load				Damage (engine housing and mounts; deck)
509	Impact/Shock			mooring operations	manual warping operation	line handling				Injury (wrist)
510	Grounding	Environment		navigation in restricted waters	low tide	current	wind			None

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
511	Environment	Impact/Shock		vessel motion	sharp corner	wave action				Injury (head)
512	Environment	Impact/Shock		wave action	mooring operation	line handling				Injury (hand)
514	Loss of Power/ Control	Overboard		high speed operation	steering control failure					Injury (head, leg, wrist)
515	Impact/Shock	Environment		wave action	material handling					Injury (head)
516	Collision w/Object			partly submerged object						Unknown
517	Impact/Shock			pinch hazard	improper maintenance					Injury (hand)
518	Leakage	Impact/Shock		wet deck						Injury (leg)
519	Grounding			navigation in restricted waters						Damage (none)
520	Impact/Shock			fall	ladder (descending)					Unknown

Coast Guard Vessel System Hazard Listing.  
(Continued)

HISAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
521	Impact/Shock	Mechanical		pinch hazard						Injury (hand)
522	Impact/Shock			ladder (ascending)	carrying object	General Quarters drill				Injury (elbow, hip)
523	Impact/Shock			fall	ladder (descending)	General Quarters drill				Injury (head)
524	Impact/Shock			material handling						Injury (knee)
525	Impact/Shock			trip hazard						Injury (ankle)
526	Impact/Shock			fall	ladder (descending)					Injury (ankle)
527	Toxicity			cleaning solvent	inadequate ventilation	improper maintenance				Injury (neurological)
528	Toxicity	Impact/Shock		object under pressure-tube of silicon	airborne material- silicon					Injury (eye, face)
529	Impact/Shock			broken glass	fire drill					Injury (hand)



**Coast Guard Vessel System Hazard Listing**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS				IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3		HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
531	Impact/Shock				fall	open deck hatch					Injury (back)
532	Impact/Shock				ladder	slip hazard	sharp object				Injury (wrist)
533	Collision w/Vessel	Environment			ice operations	loss of forward movement	navigation in restricted waters				Damage (unknown)
534	Toxicity				toxic fumes--paint	improper procedure--wearing mask incorrectly	lack of ventilation				Injury (respiratory/circulatory)
535	Impact/Shock	Equipment Failure			overhead object	sharp edge	responding to emergency				Injury (head)
536	Armaments				discharge of weapon	weapons loading operation					None
537	Impact/Shock				hard object--edge of boat						Injury (ankle)
538	Impact/Shock				cut	improper maintenance					Injury (hand)
539	Armaments				weapon discharged	weapons loading operation					None

**Coast Guard Vessel System Hazard Listing.**  
**(Continued)**

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
541	Impact/Shock	Toxicity	Leakage	corrosion inhibitor	reservoir filling operation					Injury (eyes)
542	Impact/Shock			open hatch	improper procedure-walking backwards					Injury (back, hip, knee, leg, ribs)
543	Mechanical	Impact/Shock		razor knife	opening boxes					Injury (leg)
544	Impact/Shock			fall	open deck hatch					Injury (head)
545	Equipment Failure	Impact/Shock	Environment	wave action	vessel motion	restraining loose machinery				Injury (hand)
546	Impact/Shock			material handling						Injury (thumb)
547	Mechanical			overhead object	working in confined space					Injury (head)
548	Impact/Shock	Environment		trip hazard	material handling					Injury (face)
549	Impact/Shock			pinch hazard	material handling	obstruction				Injury (hand)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS					HAZARD 8	EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5		
550	Ergonomic	Impact/Shock		working in confined space						Injury (ankle)
551	Impact/Shock			overhead object— angled bar for doorstop	jumped off deck					Injury (head)
552	Radiation			lack of eye protection	welding/flame cutting operation	improper procedure				Injury (eye)
553	Structural Failure	Impact/Shock		falling object - stokes litter						Injury (face)
554	Impact/Shock	Environment		Improper procedure	wave action					Injury (ankle)
556	Loss of Power/ Control	Overboard		vessel motion	high speed operations					None
557	Impact/Shock			fall	improper maintenance					Injury (back)
558	Environment	Impact/Shock		"pinch point"	load shifted	thumb caught between assemblies				Injury (thumb)
559	Impact/Shock			material handling	improper boarding					Injury (eye)

Coast Guard Vessel System Hazard Listing.  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
560	Impact/Shock			falling object-- hook	error--dropped hook					Injury (toes)
561	Grounding			navigation in restricted waters						Damage (unknown)
562	Impact/Shock			pinch hazard	buoy handling					Injury (hand)
564	Environment	Impact/Shock		wind swung door closed	edge--door jam					Injury (hand)
565	Impact/Shock	Structural Failure		pneumatic tool	air hose disconnect					Injury (head)
566	Environment	Collision w/Vessel	Impact/Shock	wave action	towing operation	unfamiliar procedure	line handling			Injury (head)
567	Impact/Shock	Mechanical		slippery surface-- wet transom	maintenance on operating engine	engine shroud off				Unknown
569	Impact/Shock			athletics/horsepla y--slap boxing						Injury (shoulder)
570	Overboard	Armament		vessel motion	weapon missing from holster					Damage (equipment lost)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
571	Collision w/Object	Grounding		navigation in restricted waters						Damage (prop)
573	Collision w/Object			buoy maintenance	submerged object					Damage (unknown)
574	Impact/Shock			line handling	mooring operation	pinch				Injury (hand)
575	Ergonomic			improper movement while carrying object						Injury (back)
576	Environment			hot scullery						Injury (heat exhaustion)
577	Impact/Shock			obstruction on deck	improper stowage					Injury (ankle)
578	Ergonomic			working in confined space						Injury (knee)
579	Ergonomic			working in confined space						Injury (internal)
580	Impact/Shock			fall	ladder (descending)					Injury (hand)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
581	Grounding			navigation in restricted waters	SAR operations					None
582	Impact/Shock			edge	dishwasher door					Injury (hand)
583	Collision w/vessel			combat training operations	navigation in restricted waters					Damage (unknown)
584	Impact/Shock	Environment		slippery surface-- wet deck	General Quarters drill					Injury (knee)
585	Impact/Shock			fall	loose materials on deck	improper boarding				Injury (ankle)
587	Impact/Shock			door combing	material handling					Injury (leg)
588	Leakage			high volume leak in vessel						Damage (unknown)
589	Mechanical			overhead object	material handling					Injury (head)
590	Impact/Shock			protruding object-- locking wire						Injury (hand)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
591	Impact/Shock	Burns		welding/flame cutting operation						Injury (eye)
592	Impact/Shock			pinch hazard	line handling	obstruction				Injury (hand)
594	Electrical			electrical shock	improper maintenance	water on electrical device				Injury (electrocution)
596	Loss of Power/ Control	Equipment Failure		mooring operations	engine order telegraph					None
598	Toxicity	Environment		toxic material-- gasoline spill	oil spill operation					Injury (nausea and headache)
597	Impact/Shock			buoy maintenance	buoy handling					Injury (hand)
598	Impact/Shock			grinding operation	grinding dust					Injury (eye)
599	Environment	Impact/Shock		vessel motion	grinding operation fall					Injury (knee)
600	Impact/Shock			protruding object-- latch	unsecured object-- scuttle					Injury (head)

**Coast Guard Vessel System Hazard Listing.  
(Continued)**

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
601	Impact/Shock			ladder (descending)	fall					Injury (hand)
602	Impact/Shock			Improper hold entry						Injury (back)
603	Impact/Shock			grinding operation	grinding dust					Injury (eye)
604	Impact/Shock			unsecured object to prop hatch open	falling object					Injury (hand)
605	Impact/Shock			overhead object	poor design/placement					Injury (shoulder)
606	Collision w/Object			overhead object- bridge	navigation in restricted waters					Damage (radar)
607	Leakage	Fire		acetylene	welding/flame cutting operation	improper maintenance				Unknown
609	Overboard			line handling	fall					Unknown
610	Collision w/Object	Impact/Shock		submerged object	vessel motion	fall				Injury (head)



Coast Guard Vessel System Hazard Listing.  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
611	Impact/Shock			fall	ladder (ascending)					Injury (head)
612	Mechanical			improper maintenance procedure	use of impact driver on throughbolt	strike				Injury (hand)
613	Impact/Shock			falling object	heavy object	improper procedure				Unknown
614	Impact/Shock	Toxicity		painting operations	epoxy primer	stirring operation				Injury (eye)
615	Impact/Shock			unmooring operation	improper procedure	shore tie				Damage (shore tie receptacle)
616	Collision w/Vessel			boarding vessel while underway						Damage (bullions)
617	Collision w/Object			submerged object-piling						Damage (prop)
618	Impact/Shock	Environment		edge--reefer door	vessel motion					Injury (hand)
619	Impact/Shock			sharp edge-paint can	painting operations					Injury (wrist)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
621	Explosion	Structural Failure		toxic material-acid	hydrogen gas from batteries	battery charging				Damage (battery)
622	Structural Failure	Impact/Shock		bolt failure	working in confined space					Injury (nose)
623	Impact/Shock			working in confined space	grinding operation					Injury (face)
624	Flooding/Sinking	Overboard	Environment	wave action	small boat lowering/lifting operation	swamping of boat				None
625	Mechanical	Impact/Shock		not wearing protective glasses	grinding operation					Injury (eye)
626	Structural Failure	Loss of Power/ Control	Collision w/Vessel	clutch cable	fire-fighting operations					Unknown
627	Impact/Shock	Mechanical	Armaments	pinch point-- breach	maintenance operation					Injury (hand)
628	Armaments	Equipment Failure		chaff dispenser	failure of warning system	combat drill				None
629	Impact/Shock			falling object	rack cover					Injury (hand)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
630	Impact/Shock			corroded fitting	improper maintenance					Injury (hand)
631	Environment	Collision w/Vessel		wind	towing operation	tidal current				Damage (unknown)
632	Impact/Shock			disassembling ladder	pinch					Injury (hand)
633	Structural Failure			not wearing protective glasses	cotter pin shattering					Injury (eye)
634	Loss of Power/ Control	Collision w/Vessel		engine failure	boarding vessel while underway					Damage (unknown)
635	Impact/Shock			fall	ladder (descending)	carrying object				Injury (foot)
637	Equipment Failure	Loss of Power/ Control		loss of engine cooling	hot anti-freeze	loss of propulsion				Damage (engine)
638	Impact/Shock			equipment failure-latch didn't hold						Injury (head)
640	Ergonomic			fire drill	restricted vision/movement (CBA)	improper lifting				Injury (back)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
641	Loss of Power/ Control	Collision w/Vessel		mooring operations	engine control failure	emergency engine shutdown				None
642	Impact/Shock			sharpening machete						Injury (hand)
643	Mechanical			protruding object						Injury (head)
644	Electrical			electrical shock	improper maintenance	working in confined spaces				Injury (electrocution)
645	Electrical			untagged hidden AC cable	working in confined space					Injury (arm)
646	Mechanical	Impact/Shock		working aloft	sail handling	running rigging				Injury (hand)
647	Toxicity			toxic material--toluene	splashing material					Injury (eyes)
648	Impact/Shock			fall	ladder (descending)					Injury (foot)
649	Impact/Shock			material handling						Injury (hand)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

NISHAF NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
650	Impact/Shock	Environment		boarding operations	vessel motion	fall				Injury (shoulder)
651	Ergonomic			material handling	improper lifting					Injury (back)
652	Fire			Cooking Grease						Unknown
653	Impact/Shock			protruding object						Injury (face)
654	Impact/Shock			"horseplay"						Injury (hand)
655	Impact/Shock			boarding operation						Injury (unknown)
656	Impact/Shock			stepping down to forward turtle from superstructure	wet deck	fall				Injury (back)
657	Collision w/Vessel	Environment		towing operations	wind					Damage (deck)
658	Mechanical	Impact/Shock		grinding operation	binding					Injury (arm)

Coast Guard Vessel System Hazard Listing.  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
659	Impact/Shock			working aloft	line handling					Injury (shoulder)
660	Loss of Power/ Control			engine failure						Unknown
661	Collision w/Vessel	Environment		fire fighting	pier fire	wake of other vessel				Unknown
662	Ergonomic			buoy maintenance	improper lifting					Injury (back)
663	Impact/Shock			pinch hazard	buoy handling	improper maintenance				Injury (hand)
664	Impact/Shock			protruding object						Injury (head)
665	Impact/Shock	Toxicity		sanding operations	sanding dust					Injury (eye)
666	Mechanical	Temperature		protruding object	working in confined space					Injury (head)
667	Structural Failure	Collision w/Vessel		fuel hose failure	navigating in restricted waters	loss of main engine	emergency shutdown of generator	loss of primary & emergency electrical power		Unknown

Coast Guard Vessel System Hazard Listing.  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
668	Impact/Shock			fall	painting operation	working on ladder				Unknown
670	Overboard	Impact/Shock		slippery surface— fuel on deck						None
671	Impact/Shock			door not secured	vessel motion					Injury (hand)
672	Overboard			fall	improper boarding					None
673	Grounding			navigation in restricted waters	unmooring operation					Damage (unknown)
675	Impact/Shock			fouled safety line	personnel lowering operation					Injury (hand)
676	Impact/Shock			protruding object- -davit	painting operation					Injury (knee)
677	Impact/Shock			grinding operation	grinding dust	improper procedure—safety glasses removed				Injury (eye)
678	Impact/Shock	Environment		wind	brow improperly secured					Injury (rib)

Coast Guard Vessel System Hazard Listing  
(Continued)

HISAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
679	Impact/Shock			open deck grate	fall					Injury (leg)
680	Collision w/Object			submerged object						Damage (unknown)
681	Ergonomic			lifting object	buoy maintenance					Injury (wrist)
682	Fire			welding/flame cutting operation	improper maintenance					Damage (cableway)
683	Ergonomic			material handling	improper lifting					Injury (elbow)
684	Ergonomic			improper motion						Injury (knee)
685	Collision w/Vessel			boarding vessel while underway	improper procedure					Damage (accommodation ladder, woodwork, welds)
688	Impact/Shock	Ergonomic	Environment	wave action	vessel motion					Injury (ankle)
689	Impact/Shock			material handling	loose part					Injury (foot)



**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
690	Ergonomic			material handling	improper lifting					Injury (chest muscle)
691	Impact/Shock			protruding object	ladder (descending)	slip				Injury (back)
693	Grounding			SAR operations	navigation in restricted waters	vessel drifting				Damage (prop)
694	Impact/Shock			overhead object	moving through confined spaces					Injury (head)
695	Impact/Shock			general emergency drill	improperly secured shoring					Injury (wrist)
696	Impact/Shock			sharp edge-- frame	working in confined space					Injury (hand)
697	Impact/Shock			washdown with fire hose						Injury (ear)
698	Impact/Shock			material handling	poor footing					Injury (knee)
699	Impact/Shock	Toxicity		AFF fire extinguisher fluid	automatic or manual system failure					Injury (eyes)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
701	Impact/Shock			trip hazard-metal plates stacked on deck	underway drill					Injury (elbow)
702	Impact/Shock			protruding object- -pike pole	sharp object	line handling				Injury (hand)
703	Structural Failure	Impact/Shock		glass	material handling	packing crate failure				Injury (hand)
704	Overboard			small boat lowering/lifting operation	davit repair	improper maintenance				Unknown
705	Impact/Shock	Toxicity		toxic material- paint thinner	painting operation					Injury (eyes)
706	Ergonomic			improper motion						Injury (back)
707	Collision w/Object			submerged object	structural failure - motor mount					Damage (tow rail)
708	Impact/Shock			ladder	fall					Injury (hand)
709	Impact/Shock			horseplay						Injury (head)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
710	Impact/Shock			not wearing protective glasses	flying material	chipping hammer				Injury (eye)
711	Impact/Shock			ladder (ascending)	closed hatch					Injury (head)
712	Impact/Shock	Environment		wave action	buoy maintenance	pinch between vessel & buoy				Injury (hand)
713	Impact/Shock	Ergonomic		fall	protruding object- -bracket	boarding vessel while underway				Injury (leg)
714	Toxicity	Burns		paint removal						Injury (hand)
715	Impact/Shock			protruding object- -towing crucifix	horseplay					Injury (head)
716	Mechanical	Impact/Shock		sharp edge-- banding material	banding operation					Injury (hand)
718	Impact/Shock			trip hazard	line handling					Injury (head)
719	Impact/Shock			line handling						Injury (leg)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
720	Impact/Shock			hose nozzle	hose rigging					Injury (head)
721	Impact/Shock			material handling	fail					Injury (leg)
722	Loss of Power/ Control			navigation in restricted waters	submerged object-cable					Unknown
724	Collision w/Object			overhead object-bridge	falling object					Injury (leg) Damage (mast)
725	Electrical			welding/flame cutting operation	improper procedure					Injury (burns, eye)
726	Electrical	Fire	Toxicity	electrical short	fire	smoke				Injury (smoke); damage (electrical system)
727	Armaments			unintentional discharge	holstering loaded weapon					Unknown
729	Environment	Grounding		wave action	breakwall					Unknown
730	Ergonomic			working in confined space	improper lifting					Injury (back)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
731	Ergonomic			improper lifting						Injury (neck, shoulder, back)
732	Impact/Shock			boarding vessel while underway	fall					Injury (ribs)
733	Impact/Shock			falling object- intake manifold	working in confined space					Injury (hand)
734	Collision w/Vessel	Equipment Failure		unmooring operation	engine control failure					Damage (quarter, rub rail)
735	Overboard	Impact/Shock		wave action	deck load unsecured					Injury (unknown)
736	Loss of Power/ Control	Fire	Structural Failure	oil line ruptured	engine oil	hot surface-- turbocharger				Damage (oil line, turbo alternator, wiring, blanket)
737	Impact/Shock			edge--hydr. cabinet door						Injury (hand)
738	Collision w/Object			submerged object	towing operation					Damage (prop)
739	Collision w/Object			submerged object						Damage ( prop)

Coast Guard Vessel System Hazard Listing.  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
741	Impact/Shock			fall	wet deck					Injury (fall)
742	Impact/Shock			fall	ladder (descending)	material handling				Injury (elbow)
743	Impact/Shock	Temperature		lost balance	hot object--air compressor					Injury (hand)
744	Impact/Shock			ladder (descending)	poor footing					Unknown
745	Impact/Shock			wire brushing	debris - rust					Injury (eye)
746	Mechanical	Impact/Shock		sharp edge--meat slicer	galley operation	preparing food				Injury (hand)
747	Impact/Shock			edge-door	fall					Injury (hand)
748	Structural Failure	Mechanical		working with motor casing off	exposed starter gears					Injury (hand)
749	Impact/Shock			welding/flame cutting operation	welding slag	working overhead				Injury (ear)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
750	Impact/Shock			crushing	material handling					Injury (hand)
751	Structural Failure	Impact/Shock	Environment	vessel motion	weld failed	wave action				Injury (head)
752	Impact/Shock			scuttle entry	poor footing					Injury (leg, back)
753	Impact/Shock			pinch hazard	improper maintenance					Injury (hand)
754	Impact/Shock			working aloft	improper procedure					Injury (face)
755	Ergonomic			handling buoy	improper lifting					Injury (back)
756	Impact/Shock			buoy handling						Injury (hand)
757	Toxicity			brazing operation	refrigerant					Injury (respiratory)
758	Ergonomic			working in awkward position						Injury (back)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

HISAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
759	Fire			open carburation system						Damage (engine)
760	Impact/Shock			material handling	working in confined space					Injury (teeth)
761	Mechanical			working on operating engine	improper procedure	moving part				Injury (thumb)
762	Overboard		Environment	wave action						Unknown
763	Impact/Shock			hook slipped out of hatch handle	latch fell					Injury (foot)
764	Electrical			improper maintenance						Damage (generator)
765	Impact/Shock		Collision w/Object	improper procedure	line in water					Damage (fouled prop)
766	Collision w/Vessel		Equipment Failure	engine control failure	SAR operations					Damage (sperson)
767	Impact/Shock			fall	ladder (descending)					Unknown



**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS				IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3		HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
768	Impact/Shock				grinding operation	grinding dust					Injury (eyes)
769	Impact/Shock				latch slipped						Injury (face)
771	Impact/Shock				fall	ladder (descending)	carrying object				Injury (neck)
772	Impact/Shock				rack latched up	latch failure					Unknown
773	Grounding	Environment			wave action	navigation in restricted waters					Unknown
774	Impact/Shock				open deck hatch	fall					Injury (leg)
775	Impact/Shock				cut	exposed cotter pin					Injury (hand)
776	Grounding				navigation in restricted waters						None
777	Environment	Flooding/Sinking	Overboard		wave action	boarding vessel while underway					Unknown

Coast Guard Vessel System Hazard Listing.  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
778	Grounding	Loss of Power/ Control		navigation in restricted waters						Damage (prop. shaft)
779	Impact/Shock			fall	ladder (descending)					Injury (ankle)
780	Collision w/Object			submerged object						Damage (prop)
781	Loss of Power/ Control	Equipment Failure		engine control failure	at sea replenishment operation	line handling	emergency breakage			Damage (unknown)
782	Fire	Loss of Power/ Control		emergency engine shutdown	fire - electrical					Damage (starter)
783	Impact/Shock			unsecured object	vessel motion					Injury (head)
784	Fire	Electrical		flammable adhesive	ungrounded work light					Injury (hand, arm)
785	Impact/Shock			unmooring operations	mooring operation					Damage (cable support)
786	Burns			hot water	hose connection					Injury (back)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
787	Impact/Shock			fell on deck						Injury (back)
788	Impact/Shock	Mechanical		pneumatic tool	pneumatic wrench	socket				Injury (face)
789	Temperature	Impact/Shock		welding/flame cutting operation	recently welded surface	poor footing				Injury (hand)
790	Radiation			welding/flame cutting operation	no eye protection					Injury (Eyes)
791	Impact/Shock	Structural Failure		scuttle catch failed	falling object-hatch					Injury (hand)
792	Structural Failure			seals failed	high pressure hydraulic system					Damage (steering gear)
793	Overboard			improper boarding	boarding vessel while underway	wave action				None
794	Impact/Shock			vessel motion	wet deck					Injury (head, back)
795	Impact/Shock			buoy maintenance	poor footing	fall				Injury (knee)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
796	Structural Failure			pneumatic tool	structural failure					Injury (face)
797	Impact/Shock			hatch not properly secured						Injury (leg)
798	Impact/Shock	Environment		wave action	diving	buoy recovery operation				Injury (hand)
799	Impact/Shock	Leakage		oil on deck	material handling					Unknown
800	Environment	Impact/Shock		wave action	buoy maintenance	lifting operation				Injury (hand)
801	Impact/Shock			buoy maintenance	lifting operation					Injury (head)
802	Impact/Shock			lost balance	edge-tool					Injury (head)
803	Overboard			buoy maintenance	working with boat/hook					Unknown
804	Environment	Impact/Shock		vessel motion	unsecured chair					Injury (head)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
805	Impact/Shock			buoy maintenance	lifting operations	working with boathook				Injury (face), damage (boathook)
806	Impact/Shock	Environment		protruding object-bracket	vessel motion					Injury (arm)
807	Impact/Shock	Environment		wave action	unstable footing	vessel motion				Injury (hand)
809	Impact/Shock			overhead object						Injury (head)
810	Impact/Shock			overboard drill	strobe bracket					Injury (hand)
811	Armaments			flare						Injury (hand)
812	Collision w/Object			Improper Ships Operations	mooring operation	line handling				Damage (pier structure)
813	Environment	Impact/Shock	Structural Failure	wave action	vessel motion					Damage (battery charger, weapons)
814	Mechanical			closed hatch	ladder (ascending)					Injury (head)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
815	Temperature	Impact/Shock		steam valve handle	working in confined space					Injury (back)
816	Armaments			weapons clearing operation	discharge of weapon					Unknown
817	Impact/Shock			wet deck						Unknown
818	Impact/Shock	Environment		wake created by other vessels	unstable platform	working on float alongside				Injury (head)
819	Toxicity			smoke in ventilation system						Unknown
820	Loss of Power/ Control	Grounding		engine stalled	navigation in restricted waters					Damage (RHIM)
821	Grounding			gravel bar	navigation in restricted waters					Damage (prop & shaft)
822	Impact/Shock			material handling	open deck hatch					Unknown
823	Impact/Shock			open deck hatch						Injury (unknown)

Coast Guard Vessel System Hazard Listing.  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS					EFFECT	
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5		HAZARD 8
824	Impact/Shock			poor footing						Injury (back)
825	Impact/Shock	Environment		wave action	towing operation					Injury (knee, shoulder)
826	Structural Failure	Impact/Shock		mast retainer broke	mast fell					Injury (hand)
827	Impact/Shock			slippery surface--ice on deck						Injury (shoulder, leg)
828	Environment	Impact/Shock	Capsize	wave action	vessel motion	surf operation	leakage-diesel fuel			Damage (pump, equipment lost)
829	Environment			wave action	surf operations					Damage (radar antenna, spray shield)
830	Impact/Shock			loose object on deck	fall					Injury (arm)
831	Environment			wave action	slip hazard	edge-chair				Injury (face)
832	Impact/Shock			cut	hatch improperly secured					Injury (hand)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
833	Collision w/Object			submerged line						Damage (line in prop)
834	Impact/Shock			exposed cotter pin						Injury (head)
835	Impact/Shock			falling object-- dogging lever	carrying object					Injury (wrist)
836	Collision w/Object			mooring operations						Damage (pier)
837	Impact/Shock			buoy handling	hoist operations	exceeding operating limits				Damage (unknown)
839	Impact/Shock	Structural Failure		poor footing	material handling					Injury (leg)
840	Impact/Shock	Environment		vessel motion						Injury (head)
841	Impact/Shock			slippery surface-- icy deck	material handling					Injury (knee)
842	Collision w/Object			submerged object--line						Damage (prop, shaft)



**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 8	
843	Capsize	Overboard		towing operations	flooded vessel being towed					Injury (fatality)
844	Collision w/Vessel	Environment		wave action	vessels in close formation					Damage (unknown)
845	Environment			wave action	surf operations					Unknown
846	Impact/Shock			ladder (ascending)	closed hatch					Unknown
847	Impact/Shock			line handling	towing operation					Injury (hand)
848	Impact/Shock			slippery surface— wet pilings	slip hazard					Unknown
849	Structural Failure	Impact/Shock		latch failed	vessel motion					Injury (hand)
850	Impact/Shock			ladder (descending)	fall					Unknown
851	Impact/Shock			high speed operation	trip hazard	vessel motion				Injury (unknown)

Coast Guard Vessel System Hazard Listing.  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
852	Impact/Shock			fall	ladder (descending)					Unknown
853	Equipment Failure	Impact/Shock		line handling	boarding vessel while underway					Injury (hand)
855	Environment			wave action	surf operations					Unknown
856	Environment	Capsize		wave action	surf operations					Unknown
857	Collision w/Vessel			wave action	boarding vessel while underway					Damage (hull)
858	Impact/Shock			crushing	lowering mast					Injury (hand)
859	Collision w/Object			submerged object						Damage (unknown)
860	Capsize	Environment		wave action	wind	surf operation	SAR operation			Damage (RHIB)
861	Fire			stack fire	ice operation					Unknown

Coast Guard Vessel System Hazard Listing.  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
862	Grounding			night operation	navigation in restricted waters					Damage (unknown)
864	Overboard			fall	slippery deck					None
865	Impact/Shock			buoy maintenance	lifting operations	lifting chain				Injury (eye)
866	Armaments	Impact/Shock		chain stopper	shell casing	premature firing				Injury (arm)
867	Impact/Shock			fall	ladder (descending)	carrying object				Injury (knee)
868	Impact/Shock			ladder (descending)	carrying object	safety guard rail missing	protruding object			Unknown
869	Impact/Shock	Loss of Power/Control		line in water						Damage (fouled prop)
870	Fire			fire	O/L generator					Unknown
871	Flooding/Sinking			survey operation	line handling					Damage (marker & bridle)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
872	Environment	Impact/Shock		wave action	vessel motion	surf operation				Injury (shoulder)
873	Flooding/Sinking	Environment		wave action	boat swamped	SAR operation				Damage (small boat)
874	Impact/Shock			pinch hazard	elevator door					Injury (hand)
875	Impact/Shock	Environment		wave action	vessel motion					Injury (neck)
876	Environment			tidal current	mooring operation					Damage (trim tab)
877	Grounding			tidal drop	ATON maintenance					Damage (unknown)
878	Impact/Shock			crushing	closing door					Injury (hand)
879	Fire	Loss of Power/ Control		fire	emergency engine shutdown	oil soaked lagging				Damage (lagging)
880	Impact/Shock	Environment		vessel motion	flour bin door					Injury (hand)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS								EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	HAZARD 7	HAZARD 8	
882	Collision w/Object			submerged object--fishing line								Damage (screws)
883	Structural Failure	Environment		wave action	falling object-- broken roll bar							Damage (deck cover)
884	Impact/Shock			sharp corner								Injury (head)
885	Impact/Shock			ladder (ascending)	closed hatch							Unknown
888	Flooding/Sinking			improper maintenance								Unknown
889	Impact/Shock			lifting strainer with crowbar	use of crowbar							Injury (hand)
890	Impact/Shock	Toxicity		flying object-- particle from battery	improper procedure--not wearing eye protection	battery maintenance						Injury (eye)
891	Grounding			vessel motion								Injury (knee)
894	Armaments			magazine in rifle	improper clearing procedure							None

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS								EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	HAZARD 7	HAZARD 8	
895	Impact/Shock			vessel motion	loaded drawer	sharp edge- broken bowl						Injury (hand)
896	Impact/Shock			sharp edges-- steel tags								Injury (hand)
897	Fire	Electrical		short circuit	fire							Damage (electrical wiring)
898	Fire	Equipment Failure	Loss of Power/ Control	emergency engine shutdown								Damage (engine)
899	Grounding			prop wash-- moved vessel	towing operation							None
900	Environment	Impact/Shock	Ergonomic	wave action	surf operations							Injury (shoulder)
901	Armaments			armaments training	fouled safety line							Injury (unknown); damage (trim tab, transom, bulwark)
902	Structural Failure			mooring operations	improper chain layout							Damage (padeye)
903	Grounding			surf operations								Damage (shaft)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

HMSHP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
904	Impact/Shock			pinch hazard	winch operations					Injury (hand)
905	Impact/Shock			door opened	lack of visibility/awareness s-person on other side					Injury (unknown)
906	Impact/Shock			fall	wet deck					Injury (arm)
907	Armaments			improper clearing operation	unintentional discharge					None
908	Grounding			unmarked shoal	navigation in restricted waters	high speed operations	SAR operation			Unknown
909	Structural Failure	Impact/Shock		lifting operation	safety latch failed					Injury (leg)
911	Environment	Impact/Shock		wave action	improper boarding					Unknown
912	Impact/Shock	Ergonomic		fall	obstruction on deck	improper boarding				Injury (ankle)
913	Structural Failure	Impact/Shock		support strap broke	vessel motion					Injury (ankle)

Coast Guard Vessel System Hazard Listing.  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
916	Grounding			misplaced navigation buoy						Damage (unknown)
917	Grounding			towing operations	navigation in restricted waters					Damage (hull)
918	Leakage	Loss of Power/ Control	Toxicity	oil leak	emergency engine shutdown	engine exhaust				Damage (unknown)
919	Impact/Shock			open deck hatch	limited visibility (OBA)	fire drill				Injury (leg, hip)
921	Impact/Shock	Environment		"pinch" point- under anchor line	vessel motion	weighing anchor				Injury (hand)
922	Impact/Shock			cutting operation	sharp edge					Injury (hand)
923	Impact/Shock			edge-scuttle	hatch closed					Injury (hand)
924	Overboard	Environment		cold water	Jacobs ladder	fall	overside recovery operation			Unknown
925	Structural Failure	Impact/Shock	Toxicity	closed valve on pressurized line	fueling operation	diesel fuel				Injury (eyes)



**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
926	Loss of Power/ Control	Environment		wave action	improperly secured outboard	towing operation				Damage (engine lost)
927	Burns	Electrical		electrical short	working in confined space	keyring on belt				None
928	Grounding			submerged breakwater	navigation in restricted waters					Damage (lower unit of motor)
929	Impact/Shock			ladder (descending)	knife-edge of scuttle/hatch					Injury (leg)
930	Impact/Shock			buoy maintenance						Unknown
932	Structural Failure	Impact/Shock		towing mast broke	falling object					Injury (head, elbow)
933	Environment	Impact/Shock	Ergonomic	vessel motion	swinging object	"pinch" area	small boat recovery operation			Injury (back)
934	Loss of Power/ Control			engine control failure	mooring operation					Damage (unknown)
935	Collision w/Object			submerged object--dredge pipe	hit pipe					Damage (prop)

Coast Guard Vessel System Hazard Listing.  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
937	Impact/Shock			slippery surface-- oil on boots	fall					Injury (leg)
938	Mechanical			moving part-- alternator pulley	maintenance on operating engine					Injury (hand)
939	Impact/Shock			sharp edge--light bracket	overboard emergency	strobe light bracket				Injury (hand)
940	Structural Failure			Improper operation	cleat gave way while trying to spring from pier	unmooring operation				Damage (pier fitting)
942	Environment	Overboard		wave action	line handling	vessel motion				Unknown
943	Impact/Shock			anchor handling	windlass operation					Injury (hand)
944	Capsize	Environment		wave action	surf operations					Unknown
945	Impact/Shock			carrying object-- vision obstructed	deck hatch open	fall				Injury (knee)
947	Collision w/Vessel			navigation in restricted waters	improper lookout					Injury (fatal)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
948	Impact/Shock			rotating object-- radar antenna	line handling					Damage (line around antenna shaft)
949	Collision w/Object	Environment		mooring operations	strong current					Unknown
950	Fire			fire						Damage (pipe)
951	Armaments	Equipment Failure		weapons firing test	50 cal. Machine gun	weapon limit stop failed	fired into vessel			Damage (deck fitting)
952	Impact/Shock			overboard lifting	material handling					Injury (hand)
953	Impact/Shock			Improper open hatch	fall	no safety chains				Injury (face)
954	Impact/Shock			open deck hatch	fall					Injury (arm)
955	Environment	Impact/Shock		wave action	vessel motion	slippery deck	SAR operation			Injury (leg)
956	Mechanical	Impact/Shock		line in water	unmooring operation					Damage (fouled prop)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
957	Capsize			wave action						Unknown
959	Impact/Shock			hoisting operation	small boat lowering/lifting operation	line handling	pinch	block		Injury (hand)
960	Armaments			rifle	improper clearing operation	round fired				Damage (storage box)
961	Capsize			buoy maintenance	buoy handling	hoisting operation	exceeding operation limits			Damage (engine)
962	Structural Failure			towing operations						Damage (unknown)
963	Temperature			hot object--overheated turbochargers	flammable material--insulation					None
964	Fire			fire	equipment failure (pump cooling)	improper maintenance				Damage (unknown)
965	Mechanical			unmooring operation	line in water	fouled prop				Damage (fouled prop)
966	Impact/Shock			edge--knife-edge of scuttle	closed on fingers					Injury (hand)

Coast Guard Vessel System Hazard Listing.  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS				IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3		HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
968	Collision w/Object	Environment		Impact/Shock	buoy maintenance	wave action	towing operation	low line towed prop	navigation in restricted water		Damage (hull)
969	Environment	Impact/Shock			wave action	pinch area- between boat & steel pipe structure	mooring operation				Unknown
970	Grounding				SAR operations	navigation in restricted waters					Damage (prop)
971	Structural Failure	Environment	Grounding		wave action	towing operation	low line failure	navigation in restricted waters			Damage (vessel lost)
972	Environment	Impact/Shock			wave action	towing operation	tending off vessels	crush			Injury (hand)
973	Impact/Shock	Environment			ladder (descending)	wave action	protruding object				Injury (knee)
974	Collision w/Object				submerged object	navigation in restricted waters					Damage (prop)
975	Impact/Shock				high speed operation						Injury (internal)
977	Electrical	Fire			maintenance operations	flushing sewage hose	pumping operation	electrical short			Damage (pump)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
978	Environment	Equipment Failure		wave action	hydrostatic release device	liferaft				Damage (life raft)
979	Overboard			refueling operation						Injury (fatal)
980	Collision w/Object			mooring operations						Damage (light pole on dock)
981	Environment	Impact/Shock		wave action	vessel motion					Injury (head)
982	Impact/Shock			ladder (descending)	slip hazard					Injury (leg)
983	Structural Failure			line handling	removing slack in line					Damage (cleat)
984	Collision w/Object			submerged object	towing operation	navigation in restricted waters				Damage (engine's lower unit)
986	Grounding			navigation in restricted waters						None
987	Collision w/Object			submerged object	navigation in restricted waters					Damage (prop. shaft)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
988	Environment	Toxicity		smoke	wind	fire fighting				Injury (respiratory)
989	Environment			wave action	exceeding design limits					Damage (radar support mounts)
990	Impact/Shock			ladder missing						Injury (back)
991	Collision w/Vessel	Impact/Shock		monitoring race activities	race vessel out of control					Damage (sponson)
992	Collision w/Vessel	Environment		wave action	boarding vessel while underway					Unknown
993	Impact/Shock	Environment		vessel motion	fall					Injury (head)
994	Environment	Overboard		wave action	high speed operations	vessel motion				None
995	Impact/Shock			fall	ladder (descending)	oil on deck				Injury (elbow)
996	Impact/Shock	Structural Failure		open deck hatch						Injury (arm)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
997	Fire	Equipment Failure		fire	fire extinguisher failure	SAR operation				Damage (engine room)
998	Impact/Shock			open deck hatch						Injury (unknown)
999	Loss of Power/ Control	Grounding		engine control failure	unmooring operation					Unknown
1000	Collision w/Object			submerged object	high speed operations	navigation in restricted waters				Damage (prop. shaft)
1001	Grounding			navigation in restricted waters						Unknown
1002	Impact/Shock			falling object - scuttle	ladder (descending)					Injury (hand)
1004	Overboard	Environment		wave action	SAR operations	high speed operations	vessel motion			Injury (knee)
1005	Impact/Shock			falling object - dropped parts	material handling					Injury (hand)
1006	Grounding	Impact/Shock		vessel motion	navigation in restricted waters					Injury (unknown)



Coast Guard Vessel System Hazard Listing.  
(Continued)

NISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
1007	Capsize			small boat lowering/lifting operation						None
1008	Impact/Shock			trip hazard						Injury (back)
1009	Grounding			navigation in restricted waters	ground-sand bar					Damage (unknown)
1010	Collision w/Vessel			mooring operations	engine stalled					Damage (unknown)
1011	Leakage	Fire	Loss of Power/ Control	lubricating oil leak	oil spray on hot exhaust	emergency engine shutdown	oil contamination			Damage (engine, lagging)
1012	Impact/Shock	Ergonomic	Environment	wave action	vessel seat design	vessel motion	high speed operation			Injury (back)
1013	Fire			flammable material in contact with light						Damage (floodlight)
1014	Environment	Impact/Shock		wave action	vessel motion					Injury (ankle)
1015	Mechanical	Structural Failure		shore tie connection	unmooring operation					Damage (electrical connector)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
1016	Impact/Shock	Ergonomic	Environment	vessel motion	SAR operations	wave action				Injury (back)
1017	Impact/Shock			working in confined space	poor footing					Injury (knee)
1018	Impact/Shock			slippery surface- wet deck	material handling					Unknown
1019	Impact/Shock			steering gear response	increasing propeller RPM					Injury (hand)
1020	Impact/Shock	Environment		wave action	submerged objects-nets	boarding vessel while underway				Damage (unknown)
1021	Collision w/Object			towing operations	buoy chain					Damage (prop)
1022	Environment	Collision w/Object	Equipment Failure	wind	unmooring operation	engine failure				Damage (hull)
1023	Structural Failure			hoisting operation	hoist failure	broken cable				Damage (hoist)
1024	Impact/Shock			sharp edge-knife- edge of ladder	ladder (ascending)					Injury (leg)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
1025	Grounding	Environment		wave action	navigation in restricted waters	SAR operation				Damage (unknown)
1027	Collision w/Object	Grounding	Environment	submerged object-2x4	wave action	navigation in restricted waters				Damage (prop)
1028	Structural Failure	Impact/Shock		working in confined space	rigging maintenance					Injury (face, head)
1029	Impact/Shock			"pinch point"-ram rod & door	hydraulic cylinder					Injury (arm)
1031	Environment	Impact/Shock		vessel motion						Injury (head)
1032	Impact/Shock			falling object-rack lid						Injury (hand)
1033	Equipment Failure			hoisting operation						Damage (unknown)
1034	Structural Failure	Impact/Shock		buoy maintenance	spudding operation					Damage (winch)
1035	Impact/Shock	Environment		wave action	vessel motion					Injury (elbow)

**Coast Guard Vessel System Hazard Listing.**  
**(Continued)**

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
1036	Fire	Burns	Toxicity	exhaust stack fire	carbon and fuel buildup	white hot ash & carbon expelled				Injury (burn)
1037	Structural Failure	Impact/Shock		mooring operations	falling object-spud lifting cable					Injury (leg)
1038	Impact/Shock			cut	hatch improperly secured					Injury (hand)
1039	Impact/Shock			hatch						Injury (head)
1040	Impact/Shock	Toxicity	Contamination	broken glass	mercury nitrate					Injury (hand)
1042	Environment	Impact/Shock		wave action	small boat lowering/lifting operation					Damage (davit)
1043	Environment	Impact/Shock		vessel motion	fall	wave action				Injury (head)
1044	Structural Failure	Fire		flammable liquid	improper maintenance	cleaned with canvas wiper				Damage(unknown)
1045	Fire			improper maintenance	electrical short					Damage (battery box)

Coast Guard Vessel System Hazard Listing.  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
1047	Impact/Shock	Overboard	Structural Failure	wave action	material handling	vessel motion	lifeline			Unknown
1048	Impact/Shock			ladder (descending)	carrying object	fall				Injury (hand)
1049	Mechanical	Impact/Shock		pneumatic drill	improper maintenance	changing drill bits				Injury (leg)
1051	Impact/Shock			ladder (descending)	falling object - hatch					Injury (chest)
1054	Structural Failure			tow line fouled	towing operation	weld failure				Damage (tow reel handle)
1056	Loss of Power/ Control	Structural Failure	Overboard	steering gear failure	vessel motion					Injury (leg); damage (steering system)
1057	Impact/Shock			line handling	buoy handling	hoisting operation				Injury (hand)
1058	Grounding	Overboard		submerged rock	navigation in restricted waters	vessel motion	improper maintenance			None
1059	Collision w/Object			submerged object						Damage (prop)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS								EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6			
1060	Environment	Overboard	Impact/Shock	wave action	SAR operations						Damage (prop)	
1061	Capsize	Environment		wave action	small boat lowering/lifting operation	emergency drill					Damage (unknown)	
1062	Environment	Impact/Shock		wave action	vessel motion						Damage (windshield); Injury (head)	
1063	Environment	Impact/Shock		ships maneuvering	fail						Injury (hand)	
1064	Collision w/Object	Loss of Power/ Control		mooring operations	engine control failure						Damage (dock)	
1065	Environment	Impact/Shock		sail handling	wave action	gale force winds	vessel motion	line handling			Injury (knee)	
1066	Environment	Impact/Shock		wave action	vessel motion	hatch					Injury (hand)	
1067	Collision w/Object	Overboard		high speed operation	unmanned vessel underway						Unknown	
1068	Grounding			lack of visibility— nav. lights confused w/background	navigation in restricted waters						Damage (unknown)	

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS								EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 8			
1069	Toxicity	Leakage	Environment	wave action	fuel	refueling operation				Injury (face & eyes)		
1070	Overboard	Environment		wave action						Injury (unknown)		
1071	Environment	Loss of Power/ Control	Overboard	wave action	engine failure	vessel motion				Damage (unknown)		
1072	Electrical			electrical shock	improper maintenance					Injury (electrocution)		
1073	Temperature	Mechanical		engine overheated						Damage (engine)		
1074	Environment	Structural Failure		wave action	SAR operations					Damage (antenna)		
1075	Mechanical	Impact/Shock		hatch safety latch						Injury (head)		
1076	Environment	Impact/Shock		vessel motion	protruding object- hanger frames	wave action				Injury (face)		
1077	Toxicity			fire drill	OBA without cannister	improper operation				Injury (head)		

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
1080	Armaments	Equipment Failure		round jammed & bent	primer split from casing	20mm machine gun				Damage (20mm gun)
1081	Overboard	Temperature		frozen line	towing operation	line handling				Injury (overboard?)
1082	Impact/Shock			falling object-- hatch cover						Injury (hand)
1083	Capsize	Environment		wave action	vessel motion	surf operation				Unknown
1084	Loss of Power/ Control	Capsize	Overboard	engine failure	wave action	SAR operation				Unknown
1085	Capsize	Environment		wave action	surf operations					Damage (unknown)
1086	Collision w/Object	Environment		small boat lowering/lifting operation	line handling	lifting block	strike			Injury (face)
1087	Environment	Impact/Shock		wave action	broken glass	surf operation				Damage (radar array, antennas); Injury (lacerations)
1088	Collision w/Object			submerged object	navigation in restricted waters					Damage (prop)



**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
1089	Impact/Shock			ladder (descending)	inadequate hold on rail					Injury (elbow)
1090	Environment	Impact/Shock		wave action	fall					Injury (ankle)
1092	Impact/Shock			fell from bunk						Injury (head, back, shoulder)
1093	Burns	Fire		Generator Stator Overheat	fire					Damage (generator)
1094	Loss of Power/ Control	Overboard	Impact/Shock	improper maintenance (steering linkage)	vessel motion	high speed operations	unmanned vessel			Damage (vessel)
1095	Impact/Shock			working in confined space	improper maintenance					Injury (shoulder)
1096	Contamination	Fire	Loss of Power/ Control	oil contamination of lagging	fire	emergency engine shutdown				Damage (lagging, engine)
1097	Capsize			small boat lowering/lifting operation						Unknown
1098	Toxicity			toxic substance--chlorine						Injury (respiratory)

Coast Guard Vessel System Hazard Listing.  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
1099	Overboard	Environment		wave action						Injury (face, shoulder)
1100	Collision w/Vessel			mooring operations						Unknown
1101	Temperature	Toxicity	Structural Failure	smoke	motor seized	wiring overheated				Unknown
1102	Mechanical			buoy maintenance	obstruction on deck (buoy)					Injury (head)
1103	Overboard			mooring operations	slippery deck					None
1104	Structural Failure	Toxicity	Leakage	high pressure hydraulic hose separated	hazardous substance— hydraulic oil					Unknown
1105	Equipment Failure			fuel system failure						Damage (boiler)
1106	Environment	Overboard		wave action	towing operation	vessel motion				Unknown
1107	Mechanical			hoisting operation	hydraulic system					Damage (unknown)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
1108	Collision w/Object			buoy maintenance	navigation in restricted waters	buoy chain				Damage (prop)
1109	Structural Failure	Impact/Shock		improper maintenance	line handling					Injury (knee)
1110	Impact/Shock			unsecured gear- gear adrift	sharp edge-door combing					Injury (face)
1111	Grounding			navigation in restricted waters						Damage (prop)
1112	Collision w/Object	Environment		mooring operations	line handling					Unknown
1113	Environment	Impact/Shock	Ergonomic	wave action	vessel motion	protruding object- steel stanchion				Injury (knee)
1114	Structural Failure			anchoring operation	chain runlet					Damage (shackle & anchor)
1115	Grounding	Environment	Impact/Shock	ice forced ship astern rapidly	mooring operation	line handling				Damage (cam's struck by line)
1116	Environment	Impact/Shock		vessel motion	fall from top rack					Injury (back)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

HISAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
1117	Environment	Impact/Shock		vessel motion	sharp object- metal shelving					Injury (arm)
1118	Impact/Shock			pinch hazard	obstruction	material handling				Injury (hand)
1119	Impact/Shock			slippery surface- wet deck	material handling					Injury (hand)
1120	Impact/Shock			protruding object	fall					Injury (back)
1121	Environment		Collision w/Object	wave action	submerged object	surf operations				Damage (hull)
1122	Temperature	Toxicity	Fire	smoke	hot object- fiberglass exhaust crossover tube					Damage (engine exhaust system)
1123	Impact/Shock			fall	ladder not properly secured					Injury (head)
1124	Environment	Impact/Shock	Collision w/Object	wave action	buoy maintenance					Damage (hull)
1125	Impact/Shock			trip hazard	working overhead					Injury (knee)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
1126	Leakage	Loss of Power/ Control		hose fitting	emergency engine shutdown					Damage (water, loss of power/control)
1127	Structural Failure	Impact/Shock		hoisting strap failure	small boat lowering/lifting operation					Damage (outboard lower units)
1128	Impact/Shock			pinch hazard	line handling	buoy handling				Injury (hand)
1129	Collision w/Vessel	Loss of Power/ Control		engine control failure						Unknown
1130	Impact/Shock			ladder (descending)	sharp edge-- knife-edge combing					Injury (elbow)
1131	Collision w/Object			dredging equipment adrift						Damage (paint)
1132	Impact/Shock	Structural Failure		improper operation	winch operations					Injury (arm)
1133	Mechanical	Collision w/Object		towing operations	tow line					Damage (fouled prop)
1134	Loss of Power/ Control	Environment		steering gear failure	wave action					Unknown

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
1135	Impact/Shock			working in confined space						Injury (arm)
1136	Environment	Impact/Shock	Ergonomic	wave action	protruding object- -grad rail	vessel motion				Injury (back)
1137	Impact/Shock			ladder (descending)	carrying objects					Injury (back)
1138	Armaments			round discharged	hoisting loaded weapon					Injury (leg)
1139	Loss of Power/ Control	Collision w/Object		engine control failure	towing operation	line handling				Damage (stern & aft compartments)
1140	Impact/Shock			improper operation- increased speed rather than stop	small boat lowering/lifting operation					Injury (arm)
1141	Impact/Shock			poor footing	hatch knife edge					Injury (hand)
1142	Impact/Shock			vessel motion	moored operation	dewatering operation	pump discharge hose			Damage (hull)
1143	Impact/Shock	Environment		slippery surface-- wet brow	slip hazard	high time - steep brow				Injury (shoulder)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
1145	Leakage	Loss of Power/ Control	Collision w/Object	oil leak (turbocharger)	emergency engine shutdown	loss of maneuverability	navigation in restricted waters			Damage (turbocharger, engine room, hull)
1146	Environment	Impact/Shock		wave action	fall	ladder (descending)				Injury (ankle)
1147	Impact/Shock			fall	improperly stowed items	carrying object	ladder (ascending)			Injury (back)
1148	Fire	Toxicity		electrical short	heavy smoke					Damage (unknown)
1149	Armaments			round discharged	improper procedure-safety off	transfer of loaded weapon	improper procedure-grasp weapon by trigger			None
1150	Temperature			hot object-pump cover						Injury (hand)
1151	Environment	Capsize		surf operations	wave action	SAR operation				Injury (unknown); Damage (boat total loss)
1152	Grounding			navigation in restricted waters						None
1153	Overboard	Impact/Shock		training exercise	line handling	line in water				Damage (equipment overboard)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
1154	Structural Failure	Overboard		lifeline stanchion	mooring operation					None
1155	Structural Failure			gear casing broke	winch flipped over	winch wedge in cage preventing spud from lowering	mooring operation	spud lifting operation		Damage (unknown)
1156	Mechanical			grinding operation	working in confined space					Injury (unknown)
1157	Electrical			electrical shock	improper maintenance					Injury (electrocution)
1158	Grounding	Environment		navigation in restricted waters						Unknown
1159	Impact/Shock			pressurized pneumatic hose adrift	pneumatic tool					Injury (head)
1160	Grounding			navigation in restricted waters						Damage (shaft)
1161	Explosion	Fire		fire						Damage (engine room)
1162	Impact/Shock			hand caught in chain	chain maintenance					Injury (hand)



**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
1163	Impact/Shock			counterweights fell	improper maintenance					Injury (leg)
1164	Overboard			helicopter operations	line handling					None
1165	Collision w/Object	Environment		mooring operations	wind					Damage (paint, hole)
1166	Collision w/Object			ice operations	navigation in restricted waters					Damage (hull)
1167	Collision w/Vessel	Environment		wave action	boarding vessel while underway					Damage (seams between pontoons & hull)
1168	Grounding			navigation in restricted waters						Damage (unknown)
1169	Grounding			navigation in restricted waters						Damage (keel)
1170	Overboard	Environment		wave action	vessel motion	high speed operations				Unknown
1171	Overboard			line handling	towing operation	snow on deck				None

Coast Guard Vessel System Hazard Listing.  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
1172	Impact/Shock			fall	ladder (descending)					Injury (back)
1173	Capsize	Equipment Failure		buoy lifting operation						damage (unknown)
1174	Impact/Shock			working in confined space	contacted vibration dampener	maintenance on operating engine				Injury (hand)
1175	Impact/Shock			sail handling	rigging boom vang					Damage (unknown)
1176	Impact/Shock			working in confined space						Injury (unknown)
1177	Grounding	Environment	Loss of Power/ Control	ice operations	steering gear failure					Damage (unknown)
1178	Collision w/Object	Environment		wind	mooring operation					Unknown
1179	Impact/Shock			fall	finger ring	ladder (descending)				Injury (hand)
1180	Equipment Failure	Fire		smoke	anchor winchlass clutch					Damage (unknown)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
1181	Loss of Power/ Control	Collision w/Object		mooring operations	line handling	line in water				Damage (fouled prop)
1182	Collision w/Object			mooring operations						Damage (hull)
1183	Environment	Impact/Shock		towing operations	wave action	vessel motion				Unknown
1184	Impact/Shock			fall	improperly secured ladder	ladder (descending)	carrying items			Unknown
1185	Capsize			wave action	tug rescue operation					Unknown
1186	Fire	Loss of Power/ Control		fire	emergency engine shutdown	fire pump operation				Damage (engine room)
1187	Mechanical	Impact/Shock		grinding operation						Injury (hand)
1188	Collision w/Vessel	Impact/Shock		navigation in restricted waters	high speed operations					Injury (head); damage (hull)
1189	Impact/Shock			door closed						Injury (thumb)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
1190	Impact/Shock			edge-waterlight hatch						Injury (hand)
1191	Impact/Shock			pinch hazard	belt pulley	improper maintenance				Injury (hand)
1192	Impact/Shock			ladder (descending)	fire drill	fall				Injury (knee)
1193	Collision w/Vessel	Environment		wave action	boarding vessel while underway					Damage (deck fitting)
1194	Fire			bridge heater						Damage (heater)
1195	Environment	Overboard		wave action	vessel motion					Unknown
1196	Impact/Shock	Toxicity		cut skin	toxic material--fuel					Injury (thumb)
1197	Impact/Shock			protruding object--stanchion	mooring operation	ladder (ascending)				Injury (hand)
1198	Impact/Shock			mooring operations	improper boarding					Injury (leg)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
1199	Impact/Shock			improper operation						Damage (shore tie connector on boat)
1200	Impact/Shock			edge-metal compartment	operating watertight door					Injury (hand)
1201	Overboard	Environment	Capsize	small boat lowering/lifting operation	line handling	wave action				None
1202	Impact/Shock			operating watertight door						Injury ( lip, tooth)
1203	Environment		Ergonomic	wave action	vessel motion					Injury (knee)
1204	Overboard	Environment		wave action	swimming					Injury (unknown)
1205	Impact/Shock			vessel motion						Injury (knee, ankle)
1206	Impact/Shock			trip hazard	fall					Injury (ankle)
1207	Impact/Shock			deck hatch safety latch						Injury (head)

Coast Guard Vessel System Hazard Listing.  
(Continued)

HISAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
1208	Impact/Shock			fall	ladder (descending)	material handling				Injury (rib)
1209	Impact/Shock			sharp edge-- scupper cover open	boarding vessel while underway					Damage (pontoon)
1210	Impact/Shock			boarding vessel while underway						Injury (ankle)
1211	Impact/Shock			material handling	ladder (ascending)					Injury (foot)
1212	Structural Failure	Grounding	Collision w/Object	failure of floating mooring						Unknown
1213	Impact/Shock			slippery surface-- wet deck	fall					Injury (knee)
1214	Mechanical			sharp moving object-fan blade	working in confined space					Injury (hand)
1215	Environment	Impact/Shock		wave action	vessel motion	unsecured deck plate				Injury (hand)
1216	Grounding			limestone rock pile underwater	navigation in restricted waters					Damage (prop, outlass bearing)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
1217	Ergonomic			improper lifting						Injury (back)
1218	Environment	Impact/Shock		wave action	vessel motion	use of crowbar				Injury (head)
1219	Burns			welding/flame cutting operation	improper maintenance					Injury (wrist)
1220	Toxicity	Environment		painting operations	paint splashed	sealing can				Injury (eye)
1222	Overboard			hook-belt loop	edge-side of boat	carrying object				Injury (head)
1223	Impact/Shock			material handling						Injury (hand)
1224	Overboard	Environment		wave action	exceeding design limits					Unknown
1225	Impact/Shock			hoisting operation	working in confined space					Injury (unknown)
1226	Impact/Shock			wet ladder	fall					Injury (elbow)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
1227	Collision w/Object			underwater object						Damage (engine)
1228	Toxicity			material handling	cleaning fluid					Injury (eye)
1229	Structural Failure			hoisting operation	improper rigging					Injury (foot)
1230	Impact/shock			overhead object	working in confined space					Injury (head)
1231	Collision w/Vessel			navigation in restricted waters						Damage (unknown)
1232	Collision w/Vessel			navigation in restricted waters	boarding vessel while underway					Damage (unknown)
1233	Impact/Shock			fall	ladder (descending)					Unknown
1234	Grounding			submerged rocks	navigation in restricted waters					Damage (prop, keg)
1235	Radiation			welding/flame cutting operation	welding slag	UV radiation				Injury (eyes)



Coast Guard Vessel System Hazard Listing.  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
1236	Grounding			navigation in restricted waters						Damage (unknown)
1237	Structural Failure	Loss of Power/Control	Collision w/Vessel	steering gear failure						Unknown
1238	Environment	Flooding/Sinking	Grounding	wave action	engine failure					Damage (unknown)
1239	Impact/Shock			fall	ladder (descending)					Unknown
1240	Impact/Shock			fall	ladder not in place					Injury (knee, wrist)
1241	Impact/Shock			slippery surface--wet deck	fall					Injury (knee)
1244	Impact/shock			sharp object on deck						Injury (foot)
1245	Impact/Shock			operating watertight door						Injury (hand)
1246	Collision w/Object			mooring operations	navigation in restricted waters					Damage (sponson)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
1247	Impact/Shock			boarding vessel while underway	Jacobs ladder					Injury (knee)
1248	Impact/Shock	Structural Failure		brow detached itself	working in confined space					Injury (head)
1249	Impact/Shock			trip hazard						Injury (knee)
1250	Impact/Shock			unmooring operation	SAR operations	improper procedure				Damage (broken boat- side connector)
1251	Impact/Shock			joiner door	closure mechanism					Injury (hand)
1253	Environment	Impact/Shock		wave action						Injury (neck)
1254	Impact/Shock			General Quarters drill						Injury (ankle)
1256	Impact/Shock			ladder (descending)						Injury (head)
1259	Environment	Overboard	Impact/Shock	wave action	vessel motion	boarding vessel while underway				Injury (knee)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
1260	Impact/Shock			working in confined space	wire pliers					injury (face)
1261	Impact/Shock			operating watertight door						injury (hand)
1262	Fire			SAR operations	seachest valves	miss-communication				Damage (muffler)
1263	Environment	Equipment Failure	Grounding	wave action	engine control failure	mooring operation				Damage (outdrive, clutch cable)
1265	Impact/Shock			fall	ladder (descending)					Unknown
1266	Impact/Shock			edge-knife-edge	closed door on hand					injury (hand)
1267	Collision w/Object			fire drill	fire pump suction hose					Unknown
1268	Ergonomic			material handling						injury (back)
1269	Impact/Shock			pinch hazard	buoy handling					injury (hand)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
1270	Grounding			buoy maintenance	navigation in restricted waters					Damage (unknown)
1271	Impact/Shock			trip hazard-door jam	protruding object- certificate on wall	broken glass				Injury (hand), damage (hull)
1272	Impact/Shock			crushing	improperly secured hatch	ladder (ascending)				Unknown
1273	Collision w/Vessel			navigation in restricted waters						Damage (unknown)
1275	Collision w/Vessel			SAR operations	navigation in restricted waters					Damage (unknown)
1276	Structural Failure			SAR operations	high speed operations	shift from high speed forward to high speed astern				Damage (shaft)
1277	Capsize	Flooding/Sinking		improper loading of vessel	engine stalled while dewatering					Damage (unknown)
1278	Grounding	Environment		wave action	navigation in restricted waters					Damage (engine mount)
1279	Impact/Shock			trip hazard						Injury (head, back)

**Coast Guard Vessel System Hazard Listing-**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS							EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6		
1280	Impact/Shock			vessel motion	fall	ladder (ascending)					Injury (knee)
1281	Impact/Shock			fall	ladder (descending)						Unknown
1282	Impact/Shock			material handling	cardboard box						Injury (foot)
1283	Collision w/Object			line in water	towing operation	tow line cut	vessel pulled off breakwall				Damage (prop)
1284	Impact/Shock			watertight door							Injury (head)
1286	Impact/Shock			ladder (descending)	fall						Injury (knee)
1288	Ergonomic			material handling	fuel hose						Injury (back)
1289	Environment	Impact/Shock		wave action							Injury (leg)
1290	Loss of Power/ Control			fuel starvation							Damage (unknown)

Coast Guard Vessel System Hazard Listing.  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
1291	Impact/Shock			fall	ladder (descending)	wet shoes				Injury (back)
1292	Impact/Shock			deck plate missing	improper maintenance					Injury (arm, leg)
1293	Structural Failure		Temperature	CO2 cylinder valve	boarding vessel while underway	CO2 discharge				Injury (arm, face)
1294	Structural Failure			working over the side	temporary platform	sudden jerk of safety harness				Injury (back)
1295	Grounding			navigation in restricted waters						Damage (unknown)
1296	Collision w/Object	Grounding		navigation in restricted waters						Damage (prop. shaft, stem tube)
1297	Impact/Shock			poor footing						Injury (knee)
1298	Environment	Collision w/Object		mooring operations	navigation error (tide calculation)					Damage (unknown)
1300	Impact/Shock			open deck hatch	line handling	unmooring operation				Injury (head)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS					EFFECT	
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5		HAZARD 8
1301	Electrical	Fire		improper maintenance procedure	working in confined space	electrical maintenance				Damage (electrical cable)
1302	Loss of Power/ Control	Collision w/Vessel		failure of steering gear						Damage (hull)
1304	Impact/Shock			dewatering operation	high pressure water hose					Injury (head)
1305	Impact/Shock			fall	ladder (descending)					Injury (ankle)
1306	Impact/Shock	Mechanical		fire drill	water pump suction hose	line in water				Damage (valve)
1308	Impact/Shock			use of hammer						Injury (knee)
1309	Collision w/Vessel			navigation in restricted waters	boarding vessel while underway					Damage (deck fittings)
1310	Structural Failure	Impact/Shock		working over the side	temporary scaffold	line handling				Injury (groin)
1311	Impact/Shock			open deck hatch	fall					Injury (knee)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
1312	Temperature			vessel motion	galley operation	hot soup				Injury (hand)
1313	Environment	Capsize	Overboard	wave action						Damage (unknown)
1314	Equipment Failure			small boat lowering/lifting operation	winch operations	lifting cable				Unknown
1315	Temperature			power cloths press	improper procedure	laundry operation				Injury (hand)
1316	Grounding			navigation in restricted waters						None
1318	Collision w/Object			submerged object						Damage (unknown)
1319	Impact/Shock			crowbar	material handling					Injury (head)
1320	Overboard	Environment		fall	wave action	boarding vessel while underway				Unknown
1321	Collision w/Object			floating object - plank	high speed operations					Damage (hull)



Coast Guard Vessel System Hazard Listing.  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						HAZARD 6	EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6		
1322	Flooding/Sinking			water transfer operations							Unknown
1323	Impact/Shock	Environment		pinch hazard	engine cover removed	wave action	starter bendix				Injury (hand)
1324	Collision w/Object			submerged object	navigation in restricted waters						Damage (prop, shaft, keel)
1325	Grounding			spud lowered	spud dragged across bottom						Damage (spud)
1328	Overboard			working over the side	temporary scaffold						Injury (back)
1329	Impact/Shock			door edge	door swung shut						Injury (hand)
1330	Impact/Shock			trip hazard	boarding						Injury (neck)
1331	Ergonomic			working in confined space							Injury (ankle)
1332	Toxicity	Environment	Impact/Shock	galley operation	wave action	door closer	vessel motion	gas from mixing cleanser and bleach			Injury (hand)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
1333	Impact/Shock			overhead, protruding object						Injury (head)
1334	Overboard			improper boarding	material handling					Unknown
1335	Impact/Shock			joiner door						Injury (hand)
1336	Impact/Shock			drydock operation	ships anchor	material handling				Injury (foot)
1337	Impact/Shock	Structural Failure		buoy maintenance	lifting operations	winch operation				Injury (fatal)
1338	Toxicity			paint removal	paint remover					Injury (eye)
1339	Collision w/Object			submerged object						Damage (prop)
1340	Impact/Shock			ladder (ascending)	improperly secured hatch					Injury (head)
1341	Loss of Power/ Control			improper maintenance	error prone design	loss of oil pressure	working in confined space			Damage (turbochargers)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
1342	Impact/Shock			ladder (ascending)	fall					Injury (hand)
1343	Grounding	Environment		navigation in restricted waters	SAR operations	wave action				Damage (unknown)
1344	Electrical	Fire		electric stove	vessel motion	galley operation	water			Damage (stove)
1345	Impact/Shock			slippery surface- wet deck	material handling					Injury (arm)
1346	Grounding			navigation in restricted waters						Damage (unknown)
1347	Impact/Shock			fall	ladder (descending)	wet shoes				Injury (elbow)
1348	Impact/Shock			doorway combing						Unknown
1349	Impact/Shock			fall	ladder (descending)					Unknown
1350	Environment	Structural Failure	Impact/Shock	mooring lines	fueling operation	buoy maintenance				Damage (line), injury (unknown)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS			IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3	HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
1351	Environment	Impact/Shock		wave action						Unknown
1352	Overboard	Environment		wave action	small boat lowering/lifting operation					Unknown
1353	Collision w/Object	Loss of Power/ Control		seawall	engine control failure					Damage (unknown)
1354	Impact/Shock			donning protective clothing	fall					Injury (mouth)
1355	Toxicity			paint	paint thinner					Injury (eyes)
1357	Impact/Shock			unmooring operations	line handling					Unknown
1358	Impact/Shock			fall	slippery surface- wet deck	vessel motion				Injury (back)
1359	Collision w/Object	Environment		fog	navigation in restricted waters					Damage (unknown)
1360	Impact/Shock			material handling	working in confined space					Injury (hand)

**Coast Guard Vessel System Hazard Listing.**  
(Continued)

MISHAP NUMBER	GENERIC HAZARD GROUPS				IDENTIFIED HAZARDS						EFFECT
	GROUP 1	GROUP 2	GROUP 3		HAZARD 1	HAZARD 2	HAZARD 3	HAZARD 4	HAZARD 5	HAZARD 6	
1361	Impact/Shock				material handling	fire drill					Injury (shoulder)
1362	Electrical				electric shock	improper maintenance	drilling operation				Injury (electrocution); damage (steering pump controller)
1363	Capsize	Environment			wave action	surf operations	improper conning operation				Unknown
1364	Environment	Impact/Shock			wave action	vessel motion					Injury (back)
1365	Collision w/Vessel	Environment			wave action	navigation in restricted waters	towing operation				Damage (unknown)
1366	Environment	Impact/Shock			vessel motion	hatch improperly secured					Injury (hand)
1367	Electrical	Fire			open electrical panel	positive lead made contact					Damage (power panel)
1368	Impact/Shock				fall	ladder (descending)	material handling	object on bulkhead			Injury (head)
1369	Impact/Shock				General Quarters	water tight door					Injury (head)

## **APPENDIX C**

### **Coast Guard Vessel Hazard Definition:**

#### **Coast Guard Vessel System Hazard Hierarchy**

This appendix contains a listing of vessel hazards identified in this study ranked by hazard level, hazard group, and vessel class. For the hazard level, the hazard group and the vessel class, a "probability" is cited that constitutes the number of occurrences per reported incidents in the database. The database used (the LERAM Project database) covers a four year time period from FY1989 through and including FY1992.

Hazards listed under the "A" and "B" hazard levels are deemed significant, along with the "C" and "D" level hazards having probabilities above 0.006. The listing supports other analysis that buoy tenders, patrol boats, and MLB/MSB are some of the most hazardous platforms the Coast Guard operates.

# COAST GUARD VESSEL SYSTEM HAZARD HIERARCHY

HAZARD LEVEL	Prob.	HAZARD GROUP	Prob.	VESSEL CLASS	Prob.
A	0.004	Capsize	0.001	MLB	0.001
		Collision w/Vessel	0.001	SKB	0.001
		Flooding/Sinking	0.001	WLB	0.001
		Grounding	0.001	WLB	0.001
		Impact/Shock	0.001	WLIC	0.001
		Overboard	0.001	AUX	0.001
				MLB	0.001
		Structural Failure	0.001	WLIC	0.001
B	0.009	Capsize	0.001	MSB	0.001
		Collision w/Object	0.001	UTB	0.001
		Collision w/Vessel	0.001	WPB	0.001
		Environment	0.001	WPB	0.001
		Fire	0.001	WMEC	0.001
		Impact/Shock	0.002	MSB	0.001
				WLB	0.001
				WLM	0.001
		Loss of Power/Control	0.001	MSB	0.001
				RHI	0.001
		Overboard	0.002	RHI	0.001
				WPB	0.001
		Structural Failure	0.001	WLM	0.001
		Toxicity	0.001	WMEC	0.001
C	0.287	Armaments	0.002	WMEC	0.001
				WPB	0.001
		Burns	0.002	WLR	0.001
				WMEC	0.001
				WPB	0.001
		Capsize	0.003	MLB	0.001
				MSB	0.001
				RHIB	0.002
				SKB	0.001

**COAST GUARD VESSEL SYSTEM HAZARD HIERARCHY**  
(Continued)

<b>HAZARD LEVEL</b>	<b>Prob.</b>	<b>HAZARD GROUP</b>	<b>Prob.</b>	<b>VESSEL CLASS</b>	<b>Prob.</b>
		Collision w/Object	0.007	MLB	0.001
				UTB	0.001
				WLR	0.002
				WMEC	0.002
				WPB	0.001
				WSES	0.001
				WTGB	0.001
		Collision w/Vessel	0.003	AUX	0.001
				RHIB	0.001
				SRB	0.001
				WMEC	0.001
				WPB	0.001
		Contamination	0.002	UNK	0.001
				WLB	0.001
				WMEC	0.001
		Electrical	0.006	MLB	0.001
				WHEC	0.001
				WLB	0.001
				WLIC	0.001
				WLR	0.001
				WMEC	0.002
				WPB	0.001
		Environment	0.039	WMEC	0.001
				MLB	0.005
				MSB	0.001
				RHI	0.001
				RHIB	0.007
				RHIL	0.001
				RHIM	0.001
				SKB	0.001
				SRB	0.001
				UTB	0.003
				UTL	0.001



**COAST GUARD VESSEL SYSTEM HAZARD HIERARCHY**  
(Continued)

HAZARD LEVEL	Prob.	HAZARD GROUP	Prob.	VESSEL CLASS	Prob.
				WAGB	0.001
				WHEC	0.001
				WIX	0.002
				WLB	0.004
				WLIC	0.001
				WLM	0.001
				WMEC	0.006
				WPB	0.003
				WTGB	0.001
		Equipment Failure	0.002	SRB	0.001
				WLB	0.001
				WMEC	0.001
		Ergonomic	0.016	ANB	0.001
				MLB	0.001
				RHIB	0.001
				TANB	0.001
				UNK	0.001
				UTB	0.002
				WIX	0.001
				WLB	0.003
				WLR	0.001
				WMEC	0.004
				WPB	0.003
		Fire	0.003	UNK	0.001
				WLB	0.001
				WMEC	0.001
				WSES	0.001
				WTGB	0.001
		Flooding/Sinking	0.001	SRB	0.001
				WLIC	0.001
		Grounding	0.007	MLB	0.001
				RHIM	0.001
				TANB	0.001

**COAST GUARD VESSEL SYSTEM HAZARD HIERARCHY**  
(Continued)

HAZARD LEVEL	Prob.	HAZARD GROUP	Prob.	VESSEL CLASS	Prob.
				UTB	0.001
				UTM	0.001
				WAGB	0.001
				WLB	0.001
				WLR	0.002
				WPB	0.001
				WTGB	0.001
		Impact/Shock	0.143	ASB	0.001
				BU	0.001
				BUSL	0.001
				MLB	0.007
				MSB	0.001
				PWB	0.001
				RHI	0.001
				RHIB	0.006
				RHIL	0.001
				RHIM	0.002
				SKB	0.001
				SRB	0.002
				TANB	0.001
				UNK	0.001
				UTB	0.014
				UTL	0.002
				WAGB	0.002
				WHEC	0.007
				WIX	0.004
				WLB	0.021
				WLIC	0.004
				WLM	0.005
				WLR	0.005
				WMEC	0.040
				WPB	0.013
				WTGB	0.001

**COAST GUARD VESSEL SYSTEM HAZARD HIERARCHY**  
(Continued)

HAZARD LEVEL	Prob.	HAZARD GROUP	Prob.	VESSEL CLASS	Prob.
		Leakage	0.005	WYTL	0.002
				MLB	0.001
				RHIB	0.001
				SRB	0.001
				UTB	0.001
				WLB	0.001
				WLR	0.001
				WMEC	0.001
				WSES	0.001
		Loss of Power/Control	0.006	MLB	0.001
				RHIB	0.001
				RHIM	0.001
				UTB	0.001
				WHEC	0.001
				WPB	0.001
				WSES	0.001
				WTGB	0.001
		Mechanical	0.009	RHIB	0.001
				RHIM	0.001
				SKB	0.001
				UNK	0.001
				WLB	0.001
				WLIC	0.001
				WMEC	0.002
				WPB	0.001
				WAGB	0.001
				WMEC	0.001
				WPB	0.001
		Overboard	0.005	MLB	0.001
				MSB	0.001
				RHIB	0.001
				RHIL	0.001
				SRB	0.001

**COAST GUARD VESSEL SYSTEM HAZARD HIERARCHY**  
(Continued)

<b>HAZARD LEVEL</b>	<b>Prob.</b>	<b>HAZARD GROUP</b>	<b>Prob.</b>	<b>VESSEL CLASS</b>	<b>Prob.</b>
				UTB	0.001
				WMEC	0.001
				WYTL	0.001
		Radiation	0.003	ANB	0.001
				MLB	0.001
				WLM	0.001
				WMEC	0.001
				WSES	0.001
		Structural Failure	0.010	RHIB	0.002
				UNK	0.001
				UTB	0.002
				UTL	0.001
				WLB	0.002
				WLM	0.001
				WLR	0.001
				WMEC	0.002
				WPB	0.001
		Temperature	0.001	WAGB	0.001
				WLB	0.001
		Toxicity	0.012	MLB	0.001
				MSB	0.001
				SRB	0.001
				WHEC	0.001
				WLB	0.003
				WLM	0.001
				WLR	0.001
				WMEC	0.003
				WPB	0.002
D	0.700	Armaments	0.013	RHIB	0.001
				RHIL	0.001
				TPSB	0.001
				UTB	0.002

**COAST GUARD VESSEL SYSTEM HAZARD HIERARCHY**  
(Continued)

HAZARD LEVEL	Prob.	HAZARD GROUP	Prob.	VESSEL CLASS	Prob.
				WLB	0.001
				WMEC	0.003
				WPB	0.004
				WSES	0.001
		Burns	0.007	UNK	0.001
				UTB	0.001
				WLB	0.001
				WLM	0.001
				WMEC	0.002
				WPB	0.001
				WTGB	0.001
				WYTL	0.001
		Capsize	0.008	MLB	0.003
				RHIL	0.001
				RHIM	0.001
				SKB	0.001
				SKM	0.001
				TANB	0.001
				UTL	0.001
				WP	0.001
				WPB	0.001
		Collision w/Object	0.039	ANB	0.002
				MLB	0.004
				MSB	0.001
				PWB	0.002
				RHIB	0.007
				SKB	0.001
				SRB	0.001
				TANB	0.002
				UNK	0.002
				UTB	0.008
				UTL	0.003
				WLIC	0.001

**COAST GUARD VESSEL SYSTEM HAZARD HIERARCHY**  
(Continued)

<b>HAZARD LEVEL</b>	<b>Prob.</b>	<b>HAZARD GROUP</b>	<b>Prob.</b>	<b>VESSEL CLASS</b>	<b>Prob.</b>
				WLM	0.002
				WMEC	0.002
				WP	0.001
				WPB	0.003
		Collision w/Vessel	0.022	ANB	0.001
				AUX	0.001
				HB	0.001
				MLB	0.003
				MSB	0.001
				PWB	0.001
				RHI	0.001
				RHIB	0.003
				SKB	0.001
				SRB	0.001
				UNK	0.001
				UTB	0.007
				UTL	0.001
				WHEC	0.001
				WIX	0.001
				WLM	0.001
				WPB	0.001
				WTGB	0.001
		Contamination	0.005	MLB	0.001
				UTB	0.001
				WLB	0.002
				WMEC	0.002
				WPB	0.001
		Electrical	0.009	MLB	0.001
				PWB	0.001
				SRB	0.001
				UNK	0.001
				UTB	0.002
				WIX	0.001

**COAST GUARD VESSEL SYSTEM HAZARD HIERARCHY**  
(Continued)

<b>HAZARD LEVEL</b>	<b>Prob.</b>	<b>HAZARD GROUP</b>	<b>Prob.</b>	<b>VESSEL CLASS</b>	<b>Prob.</b>
				WLB	0.002
				WMEC	0.001
				WPB	0.002
		Environment	0.082	SKI	0.001
				ANB	0.001
				BUSL	0.001
				HB	0.001
				MLB	0.009
				MSB	0.002
				PWB	0.003
				RHI	0.002
				RHIB	0.011
				RHIL	0.002
				RHIM	0.001
				SKB	0.001
				SKM	0.002
				SRB	0.002
				TANB	0.002
				UNK	0.003
				UTB	0.010
				UTL	0.004
				WHEC	0.002
				WLB	0.004
				WLM	0.002
				WLR	0.001
				WMEC	0.009
				WPB	0.007
				WTGB	0.001
		Equipment Failure	0.015	MLB	0.001
				RHI	0.001
				RHIB	0.001
				SKB	0.001
				SKI	0.001

**COAST GUARD VESSEL SYSTEM HAZARD HIERARCHY**  
(Continued)

HAZARD LEVEL	Prob.	HAZARD GROUP	Prob.	VESSEL CLASS	Prob.
				SRB	0.001
				TANB	0.001
				UNK	0.001
				UTB	0.003
				WHEC	0.001
				WLR	0.001
				WMEC	0.004
				WPB	0.002
				WSES	0.001
		Ergonomic	0.012	ANB	0.001
				MLB	0.001
				SKM	0.001
				SRB	0.001
				UNK	0.001
				UTB	0.002
				UTL	0.001
				WAGB	0.001
				WLB	0.001
				WLIC	0.001
				WLM	0.001
				WLR	0.001
				WMEC	0.002
				WPB	0.001
		Explosion	0.003	UTB	0.002
				WPB	0.001
		Fire	0.029	MLB	0.001
				PWB	0.001
				UNK	0.001
				UTB	0.004
				UTL	0.001
				WHEC	0.001
				WIX	0.001
				WLB	0.003



**COAST GUARD VESSEL SYSTEM HAZARD HIERARCHY**  
(Continued)

HAZARD LEVEL	Prob.	HAZARD GROUP	Prob.	VESSEL CLASS	Prob.
				WLM	0.001
				WLR	0.001
				WMEC	0.005
				WPB	0.005
				WSES	0.002
				WTGB	0.001
				WYTL	0.001
		Flooding/Sinking	0.004	ANB	0.001
				RHI	0.001
				RHIL	0.001
				SKM	0.001
				UNK	0.001
				UTL	0.001
				WP	0.001
		Grounding	0.034	ANB	0.002
				AUX	0.001
				BUSL	0.001
				LCM	0.001
				MLB	0.002
				RHI	0.001
				RHIB	0.001
				RHIL	0.001
				RHIM	0.001
				SRB	0.001
				TANB	0.001
				UNK	0.002
				UTB	0.012
				UTL	0.003
				WLB	0.001
				WLI	0.001
				WLM	0.002
				WLR	0.001
				WMEC	0.001

**COAST GUARD VESSEL SYSTEM HAZARD HIERARCHY**  
(Continued)

HAZARD LEVEL	Prob.	HAZARD GROUP	Prob.	VESSEL CLASS	Prob.
				WPB	0.002
				WTGB	0.001
				UTB	0.001
		Impact/Shock	0.252	ANB	0.001
				AUX	0.001
				BUSL	0.002
				HB	0.001
				MLB	0.012
				MSB	0.002
				PWB	0.003
				RHI	0.001
				RHIB	0.012
				RHIL	0.001
				RHIM	0.001
				SKB	0.001
				SKM	0.001
				SRB	0.001
				TANB	0.001
				UNK	0.008
				UTB	0.026
				UTL	0.004
				UTM	0.001
				WAGB	0.006
				WHEC	0.017
				WIX	0.002
				WLB	0.031
				WLI	0.002
				WLIC	0.004
				WLM	0.017
				WLR	0.015
				WMEC	0.061
				WPB	0.015
				WSES	0.001

**COAST GUARD VESSEL SYSTEM HAZARD HIERARCHY**  
(Continued)

HAZARD LEVEL	Prob.	HAZARD GROUP	Prob.	VESSEL CLASS	Prob.
				WTGB	0.001
				WYTL	0.006
		Leakage	0.006	RHIB	0.001
				UTB	0.001
				WAGB	0.001
				WLB	0.001
				WLM	0.001
				WMEC	0.001
				WPB	0.001
		Loss of Power/Control	0.024	WTGB	0.001
				ANB	0.001
				BUSL	0.001
				MLB	0.002
				RHI	0.001
				RHIB	0.003
				RHIL	0.001
				SKI	0.001
				SRB	0.001
				UTB	0.007
				UTL	0.001
				WLB	0.001
				WLM	0.001
				WMEC	0.001
				WPB	0.004
				WSES	0.001
		Mechanical	0.037	AUX	0.001
				MLB	0.001
				RHIB	0.001
				UNK	0.001
				UTB	0.004
				WIX	0.001
				WLB	0.002
				WLM	0.001

**COAST GUARD VESSEL SYSTEM HAZARD HIERARCHY**  
(Continued)

HAZARD LEVEL	Prob.	HAZARD GROUP	Prob.	VESSEL CLASS	Prob.
				WLR	0.002
				WMEC	0.007
				WPB	0.003
				WTGB	0.001
				WYTL	0.001
				MLB	0.001
				UTB	0.001
				UTL	0.001
				WLB	0.002
				WLM	0.002
				WLR	0.001
				WMEC	0.004
				WPB	0.001
		Overboard	0.029	MLB	0.004
				MSB	0.001
				RHI	0.001
				RHIB	0.007
				RHIL	0.001
				RHIM	0.001
				SKB	0.001
				SKM	0.001
				TANB	0.001
				UNK	0.001
				UTB	0.006
				UTL	0.001
				WHEC	0.001
				WLB	0.001
				WLM	0.001
				WMEC	0.002
				WPB	0.002
		Structural Failure	0.039	MLB	0.002
				RHIB	0.002
				RHIL	0.001

**COAST GUARD VESSEL SYSTEM HAZARD HIERARCHY**  
(Continued)

HAZARD LEVEL	Prob.	HAZARD GROUP	Prob.	VESSEL CLASS	Prob.
				SRB	0.001
				UNK	0.002
				UTB	0.005
				UTL	0.001
				UTM	0.001
				WHEC	0.001
				WIX	0.001
				WLB	0.004
				WLI	0.001
				WLIC	0.001
				WLM	0.002
				WLR	0.001
				WMEC	0.009
				WPB	0.004
				WSES	0.001
				WTGB	0.001
				WYTL	0.001
		Temperature	0.010	AUX	0.001
				PWB	0.001
				RHIB	0.001
				SRB	0.001
				UNK	0.001
				UTB	0.001
				WHEC	0.001
				WIX	0.001
				WLB	0.001
				WMEC	0.004
				WPB	0.001
		Toxicity	0.022	PWB	0.002
				RHIB	0.001
				SRB	0.001
				UTB	0.002
				UTM	0.001

**COAST GUARD VESSEL SYSTEM HAZARD HIERARCHY**  
(Continued)

<b>HAZARD LEVEL</b>	<b>Prob.</b>	<b>HAZARD GROUP</b>	<b>Prob.</b>	<b>VESSEL CLASS</b>	<b>Prob.</b>
				WAGB	0.001
				WIX	0.001
				WLB	0.003
				WLM	0.002
				WMEC	0.008
				WPB	0.001
				WSES	0.001
				WTGB	0.002

## **APPENDIX D**

### **Coast Guard Vessel Hazard Definition:**

#### **Coast Guard Vessel System Preliminary Hazard Analysis**

This appendix contains the culmination of this study, the Preliminary Hazard Analysis (PHA) listing in tabular form. To ensure readability, maintain modularity, and organizational purposes, a separate PHA is provided for each hazard group listed in Appendix A. For each hazard group's PHA, a listing of the associated hazards are presented along with a description of the effect of the hazard as determined from the mishaps reported with that hazard, the hazard level as determined by the mishap severity level, an assessment of the hazard, and comments pertaining to the hazard, effect, or assessment as applicable.

The assessment is further divided into likelihood and magnitude. The likelihood is a count of the number of occurrences of the hazard per number of incidents reported in the LERAM Project database between FY1989 and FY1992. The magnitude is related to the total costs of the mishaps containing the hazard being characterized. The costs are reported as the maximum cost of a given mishap with the hazard in question, the minimum value of the mishaps with the hazard and an average of the mishap costs associated with the hazard.

For cross reference, the first six pages of this appendix contain a listing of the mishaps which can be characterized with multiple hazard groups. Hazard groups are listed in column one in the same order as listed in Appendix A. Mishaps characterized by the hazard group in the first column along with a second or third hazard group are listed, by number in the second column sub-organized by rows of the second or third characterizing hazard group. This cross reference provides a crude illustration of hazards with high correlation values.

**Table 1. Preliminary Hazard Analyses Inter-relationships.**

HAZARD GROUP	ASSOCIATED HAZARD GROUPS (with corresponding mishap numbers)
Armament	Overboard (570)
	Equipment failure (628,951,1080)
	Impact/Shock (627,866,960)
Burns	Electrical (927,725)
	Environment (288)
	Fire (91,137,1036,1093)
	Impact/Shock (591)
	Loss of Power/Control (255)
	Structural Failure (255)
	Toxicity (64,714)
Capsize	Environment (828,856,860,944,1061,1083,1085,1151,1313,1363)
	Equipment Failure (1173)
	Flooding (1277)
	Loss of Power/Control (69,206,1084)
	Overboard (217,843,961,1201)
Collision w/Object	Environment (435,949,968,1022,1027,1086,1112,1121,1124,1165,1178,1359)
	Equipment failure (398)
	Grounding (571,1027,1296)
	Impact/Shock (610,724,765,968)
	Leakage (1145)
	Loss of Power/Control (101,405,1064,1139,1181,1353)
	Overboard (189,1067)
	Structural Failure (1212)
Collision w/Vessel	Environment (22,159,192,364,533,566,631,657,661,844,992,1167,1193,1365)
	Equipment Failure (734,766)
	Flooding (488)
	Grounding (56)
	Impact/Shock (65,991,1188)
	Loss of Power/Control (56,634,641,1129,1302)
	Structural Failure (626,667)
	Structural Failure (667,962,1237)
	Environment (1298)
Contamination	Fire (164,1096)
	Impact/Shock (241,382,1040)
	Loss of Power/Control (1096)
Electrical	Burn (725,927)
	Environment (85)
	Fire (1,47,85,726,784,897,977,1301,1344,1367)
	Leakage (199)
	Structural failure (197,380,474)



**Table 1. Preliminary Hazard Analyses Inter-relationships.  
(Continued)**

HAZARD GROUP	ASSOCIATED HAZARD GROUPS (with corresponding mishap numbers)
	Toxicity (726)
Environment	Burns (288)
	Capsize (828,856,860,944,1061,1083,1151,1313,1363)
	Collision w/Object (435,949,968,1022,1027,1086,1112,1121,1124,1165,1178,1298,1359)
	Collision w/Vessel (22,159,192,364,533,566,631,657,661,844,992,1167,1193,1365)
	Electric (85)
	Equipment failure (545,978,1022,1263)
	Ergonomic (82,139,900,933,1113,1136,1203)
	Flooding/Sinking (624,777,873,1238)
	Grounding (196,395,505,510,729,773,1025,1115,1158,1177,1238,1263,1278,1342)
	Impact/Shock (17,18,38,50,54,58,59,60,75,81,84,106,107,136,151,154,190,213,222,232,233,234,281,308,324,329,340,375,383,389,390,396,409,416,428,441,448,460,463,466,485,497,501,503,511,512,515,548,554,558,564,566,584,599,618,650,678,688,712,798),
	Impact/Shock (continued) (800,804,806,807,813,818,825,828,840,872,875,880,900,911,921,933,955,969,972,973,981,993,1012,1014,1020,1031,1035,1042,1043,1060,1062,1063,1065,1066,1076,1087,1090,1113,1116,1117,1124,1136,1143,1146,1183,1215,1218,1253,1259,1289)
	Impact/Shock (continued) (1323,1350,1351,1364,1366)
	Loss of Power/Control (69,156,334,405,926,1071,1134)
	Mechanical (38)
	Overboard (63,143,209,277,364,762,777,924,942,994,1004,1060,1070,1071,1099,1106,1170,1195,1201,1204,1224,1259,1313,1320,1352)
	Structural Failure (59,396,508,751,813,883,940,971,1074,1350)
	Toxicity (596,988,1069,1220,1332)
Equipment failure	Armaments (628,951,1080)
	Capsize (1173)
	Collision w/Object (398)
	Collision w/Vessel (734,766)
	Environment (545,978,1022,1263)
	Fire (1,989,997,1080)
	Grounding (398)
	Impact/Shock (68,360,427,535,545,853)
	Leakage (166)
	Loss of Power/Control (156,595,637,781)
	Mechanical (248,309)
	Toxicity (9)
Ergonomic	Environment (82,139,900,933,1113,1136,1203)
	Impact/Shock (5,36,40,138,283,362,465,550,688,713,912,1012,1016)
Explosion	Fire (1161)
	Impact/Shock (130)

**Table 1. Preliminary Hazard Analyses Inter-relationships.  
(Continued)**

HAZARD GROUP	ASSOCIATED HAZARD GROUPS (with corresponding mishap numbers)
Fire	Structural failure (621)
	Toxicity (227,289)
	Burns (91,137,1036,1093)
	Contamination (164,1096)
	Electrical (1,47,85,726,784,897,977,1301,1344,1367)
	Equipment failure (1,898,997,1180)
	Explosion (1161)
	Leakage (491,607,1011)
	Loss of Power/Control (250,502,736,782,879,898,1186)
	Mechanical (21)
	Structural Failure (169,474,1044)
	Temperature (49,963,1122)
	Toxicity (9,49,70,104,343,491,1036,1148)
Flooding/Sinking	Capsize (1277)
	Collision w/Vessel (488)
	Environment (777)
	Grounding (453)
	Environment (624,873,1238)
	Overboard (624)
Grounding	Collision w/Object (571,1027,1296)
	Collision w/Vessel (56)
	Environment (196,395,505,510,729,773,1025,1115,1158,1177,1238,1263,1278,1342)
	Equipment failure (398)
	Flooding (453)
	Impact/Shock (282,395,420,456,1006,1115)
	Leakage (505)
	Loss of Power/Control (206,236,334,778,820,999,1177)
	Overboard (1058)
	Structural Failure (971,1212)
	Environment (1158,1350)
Impact/Shock	Armaments (627,866,960)
	Burns (591)
	Collision w/Object (610,724,765,968)
	Collision w/Vessel (65,991,1188)
	Contamination (241,382,1040)
	Environment (17,18,38,50,54,58,59,60,75,81,84,106,107,136,151,154,190,213,222,232,233,234,281,308,324,329,340,375,383,389,390,396,409,416,428,441,448,460,463,466,485,497,501,503,511,512,515,548,554,558,564,566,584,599,618,650,678,688,712,798).

**Table 1. Preliminary Hazard Analyses Inter-relationships.**  
(Continued)

HAZARD GROUP	ASSOCIATED HAZARD GROUPS (with corresponding mishap numbers)
	Environment (continued)
	(800,804,806,807,813,818,825,828,840,872,875,880,900,911,921,933,955,969,972,973,981,993,1012,1014,1020,1031,1035,1042,1043,1060,1062,1063,1065,1066,1076,1087,1090,1113,1116,1117,1124,1136,1143,1146,1183,1215,1218,1253,1259,1289)
	Environment (continued) (1323,1350,1351,1364,1366)
	Equipment failure (68,360,427,535,545,853)
	Ergonomic (5,36,40,138,283,362,465,550,688,713,912,1012,1016)
	Explosion (130)
	Grounding (282,395,420,456,1006,1115)
	Leakage (518,541,799)
	Loss of Power/Control (136,420,869,1094)
	Mechanical
	(20,25,26,33,61,62,95,99,100,105,109,110,116,146,147,177,193,219,231,261,298,316,319,342,351,368,373,378,382,406,425,454,458,471,521,543,567,627,625,646,658,716,746,788,956,1075,965,1049,1187,1306)
	Overboard (210,279,349,356,426,670,735,1047,1153)
	Radiation (1235)
	Structural Failure
	(75,88,89,128,157,167,197,223,230,293,304,305,328,330,332,345,360,386,443,473,475,481,508,553,565,622,703,751,791,826,839,849,909,913,925,932,996,1028,1034,1037,1047,1109,1127,1132,1229,1248,1293,1294,1310,1337)
	Temperature (495,743,789,815)
	Toxicity (13,37,74,230,244,258,356,421,443,506,528,541,614,665,669,705,890,1040,1196,1332)
Leakage	Collision w/Object (1145)
	Electrical (199)
	Equipment Failure (166)
	Fire (491,607,1011)
	Grounding (505)
	Impact/Shock (518,541,799)
	Loss of Power/Control (352,918,1011,1126,1145)
	Structural Failure (169,1104)
	Structural Failure (1104)
	Toxicity (166,493,918,1069)
Loss of Power/Control	Burns (255)
	Capsize (69,206,1084)
	Collision w/Object (101,405,1064,1139,1181,1353)
	Collision w/Vessel (56,634,641,1129,1302)
	Contamination (1096)
	Environment (69,156,334,405,926,1071,1134)
	Equipment failure (156,595,637,781)
	Fire (250,502,736,782,879,898,1186)
	Grounding (206,236,334,778,820,999,1177)
	Impact/Shock (136,420,869,1094)

**Table 1. Preliminary Hazard Analyses Inter-relationships.  
(Continued)**

HAZARD GROUP	ASSOCIATED HAZARD GROUPS (with corresponding mishap numbers)
	Leakage (352,918,1011,1126,1145)
	Overboard (514,556,1056,1084,1094)
	Structural Failure (626,736,1056,1237)
Mechanical	Environment (38)
	Equipment failure (248,309)
	Fire (21)
	Impact/Shock (20,25,26,33,61,62,95,99,100,105,109,110,116,146,147,177,193,219,231,261,298,316,319,342,351,368,373,378,382,406,425,454,458,471,521,543,567,627,,625,646,658,716,746,788,,956,1075,965,1049,1187,1306
	Structural Failure (109,285,403,748)
	Temperature (666,1073)
Overboard	Armament (570)
	Capsize (217,843,961,1201)
	Collision w/Object (189,1067)
	Environment (63,143,209,277,364,762,777,924,942,994,1004,1060,1070,1071,1099,1106,1170,1195,1201,1204,1224,1259,1313,1320,1352)
	Flooding/Sinking (624)
	Grounding (1058)
	Impact/Shock (210,279,349,356,426,670,735,1047,1153)
	Loss of Power/Control (514,556,1056,1084,1094)
	Structural Failure (210,1154)
	Temperature (1081)
Radiation	Impact/Shock (1235)
Structural Failure	Burns (255)
	Collision w/Object (1212)
	Collision w/Vessel (626,667,962,1237)
	Electrical (197,380,474)
	Environment (59,396,508,751,813,883,940,971,1074,1350)
	Explosion (621)
	Fire (169,474,1044)
	Grounding (971,1212)
	Impact/Shock (75,88,89,128,157,167,197,223,230,293,304,305,328,330,332,345,360,386,443,473,475,481,508,553,565,622,703,751,791,826,839,849,909,913,925,932,996,1028,1034,1037,1047,1109,1127,1132,1229,1248,1293,1294,1310,1337)
	Leakage (169,1104)
	Loss of Power/Control (696,736,1056,1237)
	Mechanical (285,403,748,1015)
	Overboard (210,1154)
	Temperature (242,345,1101,1293)

**Table 1. Preliminary Hazard Analyses Inter-relationships.  
(Continued)**

HAZARD GROUP	ASSOCIATED HAZARD GROUPS (with corresponding mishap numbers)
	Toxicity (242,925,1104)
Temperature	Fire (49,963)
	Impact/Shock (495,743,789,815)
	Mechanical (666,1073)
	Overboard (1081)
	Structural Failure (242,345,1101,1293)
	Toxicity (1101,1122)
Toxicity	Burns (64,714)
	Electrical (726)
	Environment (596,988,1069,1220,1332)
	Equipment failure (9)
	Explosion (227,289)
	Fire (9,49,70,104,343,491,1036,1148)
	Impact/Shock (13,37,74,230,244,258,356,421,443,506,528,541,614,665,669,705,890,1040,1196,1332)
	Leakage (166,493,918,1069)
	Structural Failure (242,925,1104)
	Temperature (1101,1122)

**Table 2. Preliminary Hazard Analysis for Armaments and Military Explosives Hazard Group.**

HAZARD	EFFECT	HAZARD LEVEL	ASSESSMENT				COMMENTS	
			LIKELIHOOD	EXPOSURE	MAGNITUDE			
					Min	Max		Avg
Malfunction of crew served weapon (i.e., 50 Cal. 20mm, 3 inch).	Damage and injury due to explosion of round while partially chambered or being extracted causing shrapnel in the vicinity of the weapon. Damage or injury due to firing into own vessel due to failure of weapons limit stops.	C/D	0.006		\$0	\$5,250	\$1,151	
Unintentional firing of pistol or rifle during clearing operation.	Damage or injury from the round.	D	0.004		\$0	\$0	\$0	No damage or injury reported for these incidents probably due to use of safe area for clearing.
Unintentional firing of explosive device.	Damage or injury due to explosion, heat or flying debris.	D	0.001		\$0	\$5,040	\$2,520	
Unintentional firing of personal weapon (reason unknown).	Damage or injury due to the round.	D	0.002		\$0	\$250	\$83	
Unintentional firing of pistol during loading or holstering.	Damage or injury due to the round.	C/D	0.004		\$0	\$2,715	\$477	9mm pistol is particularly prone to this hazard.
Unintentional firing while transferring small arm from one person to another.	Potential damage or injury due to round.	D	0.001		\$0	\$0	\$0	LERAMS has only one incident of this type.

**Table 3. Preliminary Hazard Analysis for Burns Hazard Group.**

HAZARD	EFFECT	HAZARD LEVEL	ASSESSMENT					COMMENTS
			LIKELIHOOD	EXPOSURE	MAGNITUDE			
					Min	Max	Avg	
Failure of equipment seals or hoses to retain hot liquids (water, oil).	Injury due to skin exposure to hot liquid. Damage to equipment due to lack of cooling or lubricating fluids.	D	0.002		\$0	\$4,503	\$1,581	
Smoking on deck or in windy areas.	Injury due to hot ash being blown into eye.	D	0.001		\$0	\$0	\$0	
Malfunction of OBA cannister during use.	Injury due to chemical burn.	C	0.001		\$5,250	\$5,250	\$5,250	
Overheating of equipment due to malfunction.	Damage due to insulation and components due to heat.	D	0.001		\$4,600	\$4,600	\$4,600	
Heat caused by fire.	Damage or injury resulting directly from heat or large flames. Superficial damage due to hot ashes.	C/D	0.004		\$0	\$6,000	\$1,785	
Exposure to battery acid.	Injury due to chemical burn or damage due to corrosion.	D	0.00		\$0	\$240	\$120	
Electrical short circuit while doing maintenance.	Injury (flashburn) due to electrical conductivity of water or fuel.	C/D	0.001		\$0	\$375	\$188	

**Table 4. Preliminary Hazard Analysis for Capsize Hazard Group.**

HAZARD	EFFECT	HAZARD LEVEL	ASSESSMENT					COMMENTS
			LIKELIHOOD	EXPOSURE	MAGNITUDE			
					Min	Max	Avg	
Natural or man made waves while vessel was without directional control.	Damage to vessel or contents due to water or loss. Injury to personnel due to water entry or collision with part of vessel.	C/D	0.006		\$0	\$2,000	\$4,265	
Improper loading of small vessel including exceeding vessel capacity, improper distribution of load, and failure to properly secure load.	Swamping of vessel due to reduced freeboard followed by overturning. Damage or injury due to water immersion.	D	0.002		\$42	\$450	\$243	
Loss of power or directional control while operating in the surf zone.	Broaching of the vessel with subsequent roll or pitchpole resulting in damage or injury due to the force of the waves, contact with the vessel or water immersion.	C/D	0.006		\$0	\$40,375	\$12,143	
Vessel being towed while directionally unstable, usually due to partial sinking.	Damage or injury due to water immersion.	A/D	0.003		\$0	\$125,000	\$31,920	
Lifting or lowering operations of small boat or buoy.	Damage or injury due to contact with lifting vessel, vessel being lifted, or water immersion.	B/C/D	0.005		\$0	\$2,398	\$566	



Table 5. Preliminary Hazard Analysis for Collision with Object Hazard Group.

HAZARD	EFFECT	HAZARD LEVEL	ASSESSMENT				COMMENTS	
			LIKELIHOOD	EXPOSURE	MAGNITUDE			
					Min	Max	Avg	
Submerged object only detectable by special instruments.	Damage to the hull, propulsion, or steering gear of the vessel.	B/C/D	0.027		\$0	\$247,508	\$14,646	
Mooring or unmooring operations.	Damage or injury due to contact with the pier, camel or seawall, or mooring lines and equipment.	C/D	0.011		\$0	\$15,001	\$3,249	
Pier or other observable object while under power and control.	Damage or injury due to contact with the vessel or object.	C/D	0.002		\$30	\$18,000	\$11,010	
Pier or other object while not under power or control.	Damage or injury due to contact with the object.	C/D	0.008		\$0	\$4,425	\$1,657	
Submerged line.	Damage to propulsion gear due to fouling.	D	0.006		\$0	\$1,047	\$522	
Towing operations.	Damage or injury due to contact with the towed object or towing equipment.	D	0.002		\$690	\$2,000	\$1,313	
Floating object observable by lookout.	Damage or injury due to contact with the object. In small boats, this may include causing a person to be thrown overboard.	D	0.004		\$0	\$1,000	\$445	
Overhead object such as a bridge while under power and control.	Damage to topside vessel structure and equipment. Injury due to contact with the object or being hit by falling debris.	D	0.002		\$0	\$2,100	\$833	

**Table 6. Preliminary Hazard Analysis for Collision with Vessel Hazard Group.**

HAZARD	EFFECT	HAZARD LEVEL	ASSESSMENT				COMMENTS	
			LIKELIHOOD	EXPOSURE	MAGNITUDE			
					Min	Max		Avg
Waves, wake, or current that hampers vessel control.	Heavy waves overcome boat's ability to maneuver and leads ships to drift into each other.	B/C	0.009		\$0	\$3,525	\$473	
Mooring, towing, or boarding operations bring vessels into a dangerous situation.	The close interaction during mooring, towing, and boarding operations can lead vessels to collide.	A/B/D	0.013		\$0	\$250,000	\$24,576	
Engine or steering failure.	Loss of ship control leads ships to drift into each other.	C/D	0.009		\$0	\$60,000	\$6,803	
Heavy wind that hampers vessel control.	Heavy wind overcomes boat's ability to maneuver and leads ships to drift into each other.	D	0.002		\$0	\$1,537	\$769	
Poor procedure or procedure execution.	Lack of training and use of poor procedures places vessels on collision courses.	C/D	0.002		\$224	\$310,000	\$104,028	
Travel in restricted waterway.	Close proximity to other vessels leads to collision situations.	D	0.003		\$0	\$8,000	\$2,529	
Reduced visibility.	Vessel collides with unseen vessel.	D	0.001		\$250	\$250	\$250	Only one incident in LERAMS.
Nearby vessel out of control.	Vessel rammed by nearby vessel leading to structural damage and injury.	D	0.002		\$0	\$5,000	\$2,500	

**Table 7. Preliminary Hazard Analysis for Contamination Hazard Group.**

HAZARD	EFFECT	HAZARD LEVEL	ASSESSMENT				COMMENTS	
			LIKELIHOOD	EXPOSURE	MAGNITUDE			
					Min	Max	Avg	
Gasoline or fuel spilled or sprayed.	Injury to eyes and other sensory organs; potential skin irritation or internal injury if inhaled or ingested. Potential for damage to equipment due to lubrication breakdown.	C/D	0.002		\$0	\$1,965	\$983	
Acids from the battery or other hazardous substances used for maintenance.	Injury to eyes if eyes are unprotected or the substance gets behind protective eye gear. Potential damage from chemical reactions between acids or other substances and equipment.	D	0.002		\$0	\$601	\$301	
Dust from maintenance activities such as grinding, dirt on equipment or in the air, rust on objects or equipment.	Injury to eyes from airborne dust, dirt, or rust. This can occur even with protective equipment. Potential for damage to equipment if dust or dirt interferes with proper working of equipment, or if rust corrodes through equipment or vessel structures.	C/D	0.005		\$0	\$1,875	\$415	
Breached container--glass holding mercury substance shattered.	Injury due to sharp edge of container and exposure to toxic material. Material in container contaminated.	D	0.001		\$840	\$840	\$840	Only one incident of this type in the data base.

**Table 8. Preliminary Hazard Analysis for *Electrical* Hazard Group.**

HAZARD	EFFECT	HAZARD LEVEL	ASSESSMENT					COMMENTS
			LIKELIHOOD	EXPOSURE	MAGNITUDE			
					Min	Max	Avg	
Electrical short.	Electrocution injuries. Electrical system damage or equipment damage (e.g., wiring, pump).	C/D	0.007		\$0	\$20,000	\$2,812	
Unintentional contact with electrical current while performing electrical system maintenance.	Electrocution injuries. Potential for damage to equipment.	C/D	0.003		\$0	\$10,375	\$2,225	
Unintentional contact with electrical current while performing other maintenance.	Electrocution injury. Potential for equipment damage.	C/D	0.004		\$0	\$1,400	\$571	
Unintentional contact not directly related to maintenance.	Electrocution injury. Equipment damage.	D	0.002		\$0	\$0	\$0	
Conductive short due to water or moisture used on the vessel, or due to a wave washing over the deck into the supply vents.	Electrocution injury. Damage to equipment that was shorted (e.g., stove).	C/D	0.004		\$0	\$750	\$223	
Electrical arc while connecting or disconnecting electrically powered equipment.	Fire from spark ignited fumes from flammable liquid adhesive. Potential for other types of equipment damage. Electrocution injury due to contact with current. Potential for injury from a secondary effect of an arc (e.g., fire).	C	0.002		\$1,125	\$13,790	\$7,458	

Table 9. Preliminary Hazard Analysis for Environmental Conditions Hazard Group.

HAZARD	EFFECT	HAZARD LEVEL	ASSESSMENT					COMMENTS
			LIKELIHOOD	EXPOSURE	MAGNITUDE			
					Min	Max	Avg	
Encountering strong breakers.	Damage to vessel equipment and structure during surf penetration drills or other activities. Vessel capsizing and people being thrown overboard.	C/D	0.010		\$0	\$40,375	\$7,770	Several of these incidents occurred during surf penetrations drills.
Operating at low tide.	Damage to vessel due to running aground. Collision with obstacles.	C/D	0.002		\$0	\$18,000	\$6,100	These incidents seem to combine with currents to produce a collision with ground or obstacle.
Encountering stronger currents than expected.	Grounding. Damage to vessel due to collision with obstacle. Damage to obstacles (e.g., pier).	C/D	0.004		\$0	\$10,000	\$2,000	
Exposure to heat/cold temperature.	Loosing grips of ladder, personnel overboard. Heat exhaustion.	D	0.001		\$0	\$0	\$0	
Working in a dark environment.	Eye injury due to failure to wear protective eyeglasses. Injury due to tripping over objects.	C/D	0.001		\$0	\$1,500	\$750	
Working/walking on a slippery surface due to ice or snow.	Injury (e.g., head, legs, arms) due to fall. Dislocations, broken bones, and lacerations.	C/D	0.006		\$0	\$7,320	\$1,583	
Ice impairing vessel movement.	Vessel collision because one of the vessels stopped abruptly. Damage to vessel due to collision with obstacle or ground while removing ice from rudder.	C/D	0.002		\$750	\$50,000	\$19,583	

**Table 9. Preliminary Hazard Analysis for Environmental Conditions Hazard Group.**  
(Continued)

HAZARD	EFFECT	HAZARD LEVEL	ASSESSMENT				COMMENTS	
			LIKELIHOOD	EXPOSURE	MAGNITUDE			
					Min	Max		Avg
Wake generated close to another vessel.	Injury (e.g., legs, head, arms) due to personnel losing balance and falling or hitting an object. Damage to vessel's haul or equipment. Collision between vessels. Engine quitting.	C/D	0.007		\$0	\$5,040	\$754	Several of these incidents cause the personnel to lose balance.
Reduced visibility.	Eye injury due to smoke. Injury due to working in the dark. Damage due to collision with unseen obstacles or vessels.	C/D	0.002		\$0	\$375	\$125	
Objects or boat components being blown or moved by wind.	Eye injury due to objects flying in eyes. Injury due to doors/hatches closing on body parts. Injury due to body parts being hit by objects being damaged and falling off.	C/D	0.006		\$0	\$8,500	\$1,751	
Wind modifying vessel's motion/direction.	Damage to haul due to vessels being pushed on other vessels, obstacles, or in shallow waters. Damage to obstacles.	D	0.011		\$0	\$9,000	\$1,487	

**Table 9. Preliminary Hazard Analysis for Environmental Conditions Hazard Group.**  
(Continued)

HAZARD	EFFECT	HAZARD LEVEL	ASSESSMENT					COMMENTS
			LIKELIHOOD	EXPOSURE	MAGNITUDE			
					Min	Max	Avg	
Wave actions causing the vessel to roll.	Injury to personnel losing balance, being hit by object that is unsecured or has dislodged itself, doors closing. Injury due to be thrown overboard from the small boat. Damage to equipment due to objects falling or electrical short circuits.	B/C/D	0.088		\$0	\$42,975	\$2,533	
Wave actions causing vessel to capsize or break structural components.	Vessels colliding with other vessels, ground, or obstacles. Structural damage due to wave strength breaking vessel's components, dislodging equipment. Vessel capsizing or rolling excessively.	C/D	0.020		\$0	\$25,000	\$2,583	

Table 10. Preliminary Hazard Analysis for *Equipment Failure Hazard Group*.

HAZARD	EFFECT	HAZARD LEVEL	ASSESSMENT				COMMENTS	
			LIKELIHOOD	EXPOSURE	MAGNITUDE			
					Min	Max		Avg
Failure of seals or hoses.	Burns and respiratory injury due to escaping hot or toxic liquids. Equipment malfunction or failure due to loss of critical fluid (coolant, hydraulic fluid).	C/D	0.003		\$0	\$64,000	\$21,474	Only one incident of this type in the LERAMS database.
Waves, wakes, or currents inducing unusual boat movements.	Boats swamped or capsized. Abrupt movements stress boat components and force people to support themselves with fixtures that break.	D	0.001		\$2,398	\$2,398	\$2,398	
Poorly secured or suspended objects.	Results in falls when person is suspended and results in falling objects when objects are suspended. Falling objects can injure crew and damage equipment.	D	0.002		\$0	\$120	\$40	
Equipment used or stressed beyond operating limits.	Overstressed tools and equipment can be damaged and can cause injuries and damage to other equipment when they fail.	D	0.002		\$500	\$2,500	\$1,500	
Equipment strength or performance degraded due to fatigue, corrosion, or wear.	Poor maintenance, corrosion, and wear can cause tools or equipment to operate less effectively. These systems can fail, damaging the tools or equipment. They can also fail and damage other equipment and cause injuries.	C/D	0.006		\$0	\$2,325	\$744	



**Table 10. Preliminary Hazard Analysis for Equipment Failure Hazard Group.**  
(Continued)

HAZARD	EFFECT	HAZARD LEVEL	ASSESSMENT					COMMENTS
			LIKELIHOOD	EXPOSURE	MAGNITUDE			
					Min	Max	Avg	
Poorly designed or manufactured equipment.	Poor manufacturing can cause tools or equipment to operate less effectively. These systems can fail, damaging the tools or equipment. They can also fail and damage other equipment and cause injuries.	C/D	0.005		\$0	\$5,250	\$1,073	
Inadequate resources (fuel).	Failure to carry adequate supplies, fuel in particular, can jeopardize a mission, crew, and boat. For example, lack of fuel can lead to engine failure and a grounding or collision.	C	0.001		\$5,396	\$5,396	\$5,396	

Table 11. Preliminary Hazard Analysis for *Ergonomic Hazard Group*.

HAZARD	EFFECT	HAZARD LEVEL	ASSESSMENT				COMMENTS	
			LIKELIHOOD	EXPOSURE	MAGNITUDE			
					Min	Max		Avg
Lifting and/or carrying heavy objects.	Injuries to back and arm areas: strains, pulled muscles, etc. Potential for injuries to other body parts used in lifting or carrying.	C/D	0.010		\$120	\$11,751	\$2,445	
Manual handling of buoys.	Injuries to back and wrist. Potential for injuries to other body parts that might be used in lifting buoys.	C/D	0.002		\$840	\$7,725	\$4,535	
Twisting or turning while lifting or carrying objects; cranking.	Primarily back injuries; groin injury.	C/D	0.003		\$0	\$4,125	\$1,848	
Pulling heavy objects: cable, sinker, fuel hose.	Back injuries. Potential for injury to other body parts used in pulling.	C/D	0.002		\$480	\$751	\$650	
Unspecified materials handling motion.	Back and chest muscle injuries. Potential for injuries to other body parts used in handling materials.	C/D	0.003		\$0	\$3,075	\$1,380	
Maintaining static work positions in awkward places while performing maintenance.	Knee and back injuries when returning to a normal posture from the static posture. Potential for injury to other body parts used to perform static work.	C/D	0.002		\$240	\$1,620	\$930	

**Table 11. Preliminary Hazard Analysis for Ergonomic Hazard Group.**  
(Continued)

HAZARD	EFFECT	HAZARD LEVEL	ASSESSMENT				COMMENTS	
			LIKELIHOOD	EXPOSURE	MAGNITUDE			
					Min	Max	Avg	
Foot/feet in awkward position due to deck geometry (angles or objects attached to deck).	Ankle injuries.	C	0.002		\$3,750	\$4,900	\$4,325	
Twisted foot for no apparent reason while carrying object across deck.	Foot/ankle injury.	D	0.0008		\$0	\$0	\$0	Only one incident of this type.
Twisted knee when removing coveralls.	Knee injury.	D	0.0008		\$2,520	\$2,520	\$2,520	Only one incident of this type.

**Table 12. Preliminary Hazard Analysis for *Explosion* Hazard Group.**

HAZARD	EFFECT	HAZARD LEVEL	ASSESSMENT					COMMENTS
			LIKELIHOOD	EXPOSURE	MAGNITUDE			
					Min	Max	Avg	
Ignition of battery gases.	Damage or injury due to blast effects, heat, and spillage of battery acid.	C/D	0.002		\$1	\$4,901	\$2,450	
Failure of a pressure or vacuum vessel.	Damage or injury due to blast effects and flying debris.	D	0.002		\$140	\$335	\$222	
Ignition of fuel, dust, or vapors.	Damage or injury due to blast effects and heat.	D	0.001		\$1,500	\$1,500	\$1,500	Only one incident in LERAMS database for this hazard.

**Table 13. Preliminary Hazard Analysis for Fire Hazard Group.**

HAZARD	EFFECT	HAZARD LEVEL	ASSESSMENT				COMMENTS	
			LIKELIHOOD	EXPOSURE	MAGNITUDE			
					Min	Max	Avg	
Turbocharger or engine exhaust overheating or catching in fire.	Equipment damage due to smoke or fire. Ignition of insulation. Risks of smoke inhalation.	D	0.006		\$0	\$4,500	\$1,164	
Failure of seals and hoses in proximity to hot equipment.	Equipment damage due to smoke or fire caused by the oil or fuel getting in contact with hot surfaces. Loss of power due to loss of engine oil. Risks of smoke inhalation.	C/D	0.004		\$0	\$50,000	\$10,376	In some cases, the seal/hose failure happened during maintenance repairs. The average cost figure is inflated due to one incident. Without this incident the magnitude (max) and (avg) are respectively \$1304 and \$470.
Smoke generated by the anchor windlass clutch.	Damage due to smoke and risk of fire.	D	0.001			\$1,500	\$1,500	
Electrical short circuit during maintenance activities.	Damage to the electrical panel.	D	0.004		\$0	\$720	\$248	Two of these incidents involve connecting the electrical power to shore.
Electrical short circuit during operations.	Damage to the electrical panel (main propulsion switchboard) or other equipment (air conditioner, alternator, generator) due to fire. Injury to personnel due to fire or sparks.	D	0.004		\$0	\$4,600	\$1,036	
Electrical short circuit due to contact of an ignition source with a liquid.	Damage to equipment due to electrical short circuit and fire.	D	0.002		\$0	\$150	\$67	
Testing equipment and leaving it unattended.	Damage to equipment due to overheating or electrical short circuit.	D	0.001		\$59	\$230	\$145	

**Table 13. Preliminary Hazard Analysis for Fire Hazard Group.**  
(Continued)

HAZARD	EFFECT	HAZARD LEVEL	ASSESSMENT					COMMENTS
			LIKELIHOOD	EXPOSURE	MAGNITUDE			
					Min	Max	Avg	
Welding slag falling on flammable material. Sparks generated by welding activities.	Damage to equipment due to fire or smoke. Injury to personnel due to fire. Risks of smoke inhalation.	D	0.004		\$0	\$6,000	\$1,800	
Electrical short circuit in the fire pump when using it to flush sewage.	Damage to fire pump and electrical connections due to fire. Risks of smoke Inhalation.	D	0.002		\$0	\$4,500	\$1,700	
Exposure of flammable material (e.g., oil, fuel, cooking grease) to an Ignition source (sparks or hot surfaces).	Damage to equipment or clothing due to fire. Burn injury due to equipment or clothing catching fire. Risks of smoke inhalation.	C/D	0.008		\$0	\$13,790	\$1,903	The average cost estimate is inflated by one Incident. Without this Incident, the magnitude (max) and (avg) are respectively \$3000 and \$728.
Ignition of oil soaked lagging/insulation due to engine overheating, increases in boat speed, or contact with hot surfaces.	Damage to turbocharger, muffler, or other equipment due to smoke or fire.	D	0.004		\$0	\$986	\$510	
Relighting of a flare after being exposed to water.	Burn injury to personnel.	D	0.001			\$720	\$720	
Failure to provide exhaust cooling. Sparks originating from exhaust.	Damage to equipment due to fire or smoke. Burn injury to personnel due to sparks getting in contact with clothing.	B/C/D	0.005		\$0	\$250,000	\$35,829	The average cost is inflated due to one Incident. Without this Incident the magnitude (max) and (avg) would be respectively \$800 and \$133.
Using a flammable material to clean an operating electrical devices.	Damage to equipment due to sparks and fire.	D	0.001			\$766	\$766	

**Table 14. Preliminary Hazard Analysis for *Flooding/Sinking* Hazard Group.**

HAZARD	EFFECT	HAZARD LEVEL	ASSESSMENT					COMMENTS
			LIKELIHOOD	EXPOSURE	MAGNITUDE			
					Min	Max	Avg	
Wave action put excessive amount of water in the vessel.	Water damage to vessel components, loss of vessel, or injury to personnel due to water immersion.	D	0.002		\$500	\$4,675	\$2,598	
Breach of hull integrity.	Water damage to vessel components, loss of vessel, or injury to personnel due to water immersion.	A/C	0.002		\$0	\$37,001,500	\$18,500,750	This hazard includes the total loss of a Cutter which ran up on rocks and sank.
Failure or Improper positioning of valve or fitting.	Water damage to vessel components, loss of vessel, or injury to personnel due to water immersion.	C/D	0.002		\$0	\$50,000	\$25,000	

Table 15. Preliminary Hazard Analysis for Grounding Hazard Group.

HAZARD	EFFECT	HAZARD LEVEL	ASSESSMENT				COMMENTS	
			LIKELIHOOD	EXPOSURE	MAGNITUDE			
					Min	Max		Avg
Navigation aids improperly positioned or inaccurate charts.	Damage to hull, propulsion gear and rudder due to contact with sand and rocks. Damage to propulsion machinery due to blockage of cooling water intake. Injury due to individuals being thrown into vessel or overboard by sudden stop.	C/D	0.001		\$0	\$63,000	\$4,940	
Maneuvering restricted due to mission or situation.	Damage to hull, propulsion gear and rudder due to contact with sand and rocks. Damage to propulsion machinery due to blockage of cooling water intake.	C/D	0.004		\$0	\$100,000	\$20,800	
Loss of maneuverability due to loss of power or steering control or malfunction.	Damage to hull, propulsion gear and rudder due to contact with sand and rocks. Damage to propulsion machinery due to blockage of cooling water intake. Injury due to individuals being thrown into vessel or overboard by sudden stop.	C/D	0.010		\$0	\$100,000	\$12,407	
Wave or tidal action.	Damage to hull, propulsion gear and rudder due to contact with sand and rocks. Damage to propulsion machinery due to blockage of cooling water intake. Possible injury due to subsequent capsizing in surf.	C/D	0.005		\$0	\$5,000	\$1,332	



**Table 15. Preliminary Hazard Analysis for Grounding Hazard Group.**  
(Continued)

HAZARD	EFFECT	HAZARD LEVEL	ASSESSMENT				COMMENTS	
			LIKELIHOOD	EXPOSURE	MAGNITUDE			
					Min	Max		Avg
Maneuvering while mooring or unerring.	Damage to hull, propulsion gear and rudder due to contact with sand and rocks. Damage to propulsion machinery due to blockage of cooling water intake. Possible injury while attempting to snub with lines or from trying to fend off.	C/D	0.003		\$0	\$60,000	\$15,031	
Navigation error.	Damage to hull, propulsion gear and rudder due to contact with sand and rocks. Damage to propulsion machinery due to blockage of cooling water intake. Injury due to individuals being thrown into vessel or overboard by sudden stop.	A/C/D	0.023		\$0	\$37,001,500	\$1,278,743	Magnitude estimate for this hazard are heavily influenced by the loss of a single cutter. Without this incident magnitude would be: min. \$0/max. \$50,000/avg. \$2930.
Tide fall while moored.	Damage to hull, propulsion or steering gear due to weight of vessel on rocks or outcroppings.	D	0.001		\$1	\$1	\$1	Only one incident in LERAMS representing this hazard

**Table 16. Preliminary Hazard Analysis for Impact and Shock Hazard Group.**

HAZARD	EFFECT	HAZARD LEVEL	ASSESSMENT				COMMENTS	
			LIKELIHOOD	EXPOSURE	MAGNITUDE			
					Min	Max		Avg
Falls from ladders, other vessel structures, or objects (e.g., turtle, buoy, scaffolding, chair, engine).	Injuries to head, hands, arms, legs, feet, ankles, back. Potential for injury to any body parts that receive impact or get caught in the fall.	C/D	0.060		\$0	\$20,475	\$2,193	
Hatches, doors, or drawers closing; due to lack of securement, failed supports, crew members closing them, swinging shut with vessel motion.	Injuries to hands, head, and legs most common. Potential injury to any body parts that could get caught in closing hatches/doors/ drawers.	C/D	0.040		\$0	\$37,680	\$2,412	
Trip over object on deck, slip on deck or other object.	Primarily injuries to ankle, foot, leg, hand, arm, etc. Radio lost when crew member tripped. Potential for other injuries. Potential for damage to equipment if dropped when a person trips, or if a person fall on/into equipment.	C/D	0.070		\$0	\$42,975	\$2,800	
Waves hitting vessel or washing over the vessel.	Injuries to head, back, leg, ankle, etc. Damage to propeller, radar array, antenna, etc. Potential for other injuries. Potential for damage to other equipment.	C/D	0.050		\$0	\$33,325	\$2,428	
Boarding/deboarding falls, or other jumping motions (e.g., jumping out of rack, off of other objects).	Primarily injuries to legs, ankles, knees. Potential for injuries to other body parts. Potential for damage if a person fell on equipment.	C/D	0.020		\$0	\$16,230	\$2,935	

**Table 16. Preliminary Hazard Analysis for Impact and Shock Hazard Group.**  
(Continued)

HAZARD	EFFECT	HAZARD LEVEL	ASSESSMENT				COMMENTS	
			LIKELIHOOD	EXPOSURE	MAGNITUDE			
					Min	Max	Avg	
Open hatch or scuttle that crew members step into or fall through.	Injuries to head, back, arms, legs, etc. Potential injury for any part of body impacted in fall.	C/D	0.020		\$0	\$14,250	\$1,883	
Airborne material, typically from maintenance activities.	Primarily injuries to eyes from materials entering eyes. Also ear, leg, and back injuries	C/D	0.030		\$0	\$6,675	\$426	This type of hazard is associated with Toxicity, as the airborne materials from maintenance activities often cause physiological problems.
Swinging or strained objects (e.g., hoisted objects, snapped lines or chains).	Injuries to knees, hands, arms, legs. Damage to antenna, engine mounts. Potential of injuries to other body parts. Potential damage to other equipment.	C/D	0.040		\$0	\$115,000	\$4,773	
Falling or flying objects.	Injury to hands, head, face, legs, feet; one fatality. Damage to various types of equipment.	A/B/C/D	0.090		\$0	\$501,630	\$8,445	
Pinch points with tools, machinery, or line handling (e.g., blocks, lines).	Injuries to hands, arms, legs, etc. Potential for injury to any body part that gets in a pinch point.	C/D	0.050		\$0	\$115,000	\$3,341	
Objects overhead, on the walls; typically contact with edges of objects.	Injuries to head, hands, legs, knees. Potential for injury to any body part that impacts an object.	C/D	0.040		\$0	\$5,400	\$658	

**Table 16. Preliminary Hazard Analysis for Impact and Shock Hazard Group.**  
(Continued)

HAZARD	EFFECT	HAZARD LEVEL	ASSESSMENT				COMMENTS	
			LIKELIHOOD	EXPOSURE	MAGNITUDE			
					Min	Max		Avg
Pushed , pulled, or rolled objects; vessel movement such that an object or body part is impacted between vessels or the vessel and another object.	Primarily injuries to hands; also leg, back, arm injuries. Potential for injuries to other body parts. Damage to shore tie cable. Potential for damage to other equipment.	C/D	0.030		\$0	\$36,900	\$2,189	
Athletics or horseplay.	Injuries to ankle, head shoulder, hand, etc. Potential for other injuries.	C/D	0.004		\$0	\$10,875	\$3,198	

**Table 17. Preliminary Hazard Analysis for Leakage Hazard Group.**

HAZARD	EFFECT	HAZARD LEVEL	ASSESSMENT				COMMENTS	
			LIKELIHOOD	EXPOSURE	MAGNITUDE			
					Min	Max		Avg
Failure of seals or hoses.	Burns and respiratory injury due to escaping hot or toxic liquids. Equipment malfunction or failure due to loss of critical fluid (coolant, hydraulic fluid).	C/D	0.013		\$0	\$50,000	\$6,351	
Valve, cap, or cover failed or left open.	Eye and face injury due to exposure to hazardous substances. Loss of critical equipment fluids (oil, fuel).	C/D	0.002		\$0	\$1,125	\$375	
Waves, wakes, or currents that flood areas of the boat.	Flooding of critical areas leading to steering or engine failure. Eye and face injury due to exposure to hazardous substances agitated by wave action.	C/D	0.006		\$0	\$100,000	\$25,955	

Table 18. Preliminary Hazard Analysis for Loss of Power/Control Hazard Group.

HAZARD	EFFECT	HAZARD LEVEL	ASSESSMENT				COMMENTS	
			LIKELIHOOD	EXPOSURE	MAGNITUDE			
					Min	Max		Avg
Intentional engine shutdown to minimize damage caused by another event.	Damage or injury primarily related to the initiating event requiring the shutdown.	C/D	0.016		\$0	\$64,000	\$12,260	
Inadvertent shutdown using safety device, i.e., kill switch.	Damage or injury due to loss of control of vessel, particularly in extreme conditions such as surf operations.	C	0.001		\$20,000	\$20,000	\$20,000	Only one incident recorded in LERAMS for this hazard.
Fouled propeller due to vessels own lines in water.	Damage to propeller or shaft due to binding of shaft. Damage due to loss of control in extreme conditions such as surf operations. Damage to propulsion gear including clutch and couplings. Potential injury due to personnel becoming tangled in line.	C/D	0.003		\$0	\$100,000	\$26,783	
Fouled propeller due to lines in water, e.g., fishing, and buoy lines.	Damage to propeller or shaft due to binding of shaft. Damage due to loss of control in extreme conditions such as surf operations. Damage to propulsion gear including clutch and couplings.	D	0.002		\$0	\$4,000	\$2,000	
Failure of outboard motor to start after stall or shutoff.	Damage to vessel due to loss of control in extreme conditions such as surf operations. Potential injury due to water immersion and capsaze.	D	0.002		\$0	\$500	\$333	

**Table 18. Preliminary Hazard Analysis for Loss of Power/Control Hazard Group.**  
(Continued)

HAZARD	EFFECT	HAZARD LEVEL	ASSESSMENT					COMMENTS
			LIKELIHOOD	EXPOSURE	MAGNITUDE			
					Min	Max	Avg	
Fuel starvation.	Damage to vessel due to loss of control in extreme conditions such as surf operations. Potential injury due to water immersion and capsizing.	D	0.002		\$2,000	\$2,600	\$2,300	
Improper response of propulsion or steering to controls.	Damage or injury due to collision with vessels and other objects.	D	0.009		\$0	\$5,400	\$1,167	
Propulsion machinery failure.	Damage or injury due to loss of control of vessel, particularly in extreme conditions such as surf operations.	C/D	0.009		\$0	\$25,000	\$3,169	
Failure of steering gear.	Damage or injury due to collision with other vessels or objects. Damage or injury due to water immersion or capsizing of small boats operating at high speed at the time of the failure.	B/D	0.004		\$0	\$115,000	\$25,349	
Failure of engine spaces to respond properly to engine telegraph.	Potential damage or injury due to collision with vessels or other objects.	D	0.001		\$0	\$0	\$0	Only one incident in LERAMS for this hazard.

Table 19. Preliminary Hazard Analysis for *Mechanical Hazard Group*.

HAZARD	EFFECT	HAZARD LEVEL	ASSESSMENT					COMMENTS
			LIKELIHOOD	EXPOSURE	MAGNITUDE			
					Min	Max	Avg	
Unguarded moving and rotating equipment.	Unguarded machinery can lead to cuts, abrasions, and lacerations when crew members come in contact with it.	C/D	0.013		\$0	\$8,610	\$1,960	
Exposed sharp edges or pinch points.	Exposed edges and pinchpoints can lead to lacerations, amputations, and crushing injuries if crew contact them.	C/D	0.006		\$0	\$375	\$105	
Improper use of equipment (crew injury).	Improperly used equipment can cause a wide variety of injuries from cuts with knives to sprained ankles due to falls.	C/D	0.004		\$0	\$4,725	\$1,812	
Improper use of equipment (equipment damage).	Improperly used equipment can lead to property damage to the equipment or associated components.	D	0.002		0	500	\$224	
Protruding or overhanging objects.	Protruding or overhanging objects generally result in head injuries as people hit or scrape their heads over the protrusion (bolts, valves, hatches).	C/D	0.009		0	\$375	\$112	



**Table 19. Preliminary Hazard Analysis for Mechanical Hazard Group.**  
(Continued)

HAZARD	EFFECT	HAZARD LEVEL	ASSESSMENT				COMMENTS	
			LIKELIHOOD	EXPOSURE	MAGNITUDE			
					Min	Max	Avg	
Loss of control of tools and equipment.	Loosing control of equipment frequently leads to hand injuries, as when a knife slips and cuts the user. Additionally, loss of control can also injure face, arms, and legs, as when a grinder catches and is flung into someone's leg.	C/D	0.032		\$0	\$33,750	\$1,460	
Inadequate protective clothing or equipment.	Inadequate protective equipment (safety glasses, gloves, and fire retardant overalls) can lead to a variety of injuries including burns and particularly eye injuries.	D	0.004		\$0	\$120	\$48	
Poorly secured or suspended objects.	Poorly secured objects can fall or shift. Falling or rolling objects can crush hands or heads. Specifically, poorly functioning latches can release hatches to fall on heads or hands.	D	0.006		\$0	\$120	\$24	
Poorly secured or suspended objects.	Poorly secured objects can also damage equipment by crushing equipment when they break loose. Improperly secured lines can drift through the water and foul the screw or propeller.	C/D	0.008		\$0	\$22,000	\$2,514	
Airborne projectiles.	Equipment failure that generates fragments	C/D	0.002		\$240	\$375	\$308	

Table 20. Preliminary Hazard Analysis for Overboard Hazard Group.

HAZARD	EFFECT	HAZARD LEVEL	ASSESSMENT				COMMENTS	
			LIKELIHOOD	EXPOSURE	MAGNITUDE			
					Min	Max		Avg
Man made or natural waves that either cause the vessel to move unexpectedly or wash across the deck.	Injury due to the fall or collision with parts of the vessel or through drowning. Damage due to force of the wave.	A/B/C/D	0.020		\$0	\$125,000	\$6,403	Two incidents have an inflated value. Without these incidents, the value for magnitude (max) and (avg) are respectively \$4675 and \$916.
Improper boarding including failure to use proper equipment or technique.	Injury due to fall or striking object prior to going overboard.	B/C/D	0.010		\$0	\$2,500	\$483	
Line handling in connection with mooring, boarding or towing operations.	Injury due to fall or contact with object prior to falling overboard. Damage due to loss of equipment (e.g., weapon or tools) carried by the individual.	B/C/D	0.007		\$0	\$2,340	\$358	
Climbing up or down ladder which is slippery or difficult to hold on to.	Injury caused by contact with vessel or other obstruction.	C/D	0.003		\$0	\$1,350	\$338	
Participation in towing operations as salvage or repair crew on disabled and partially submerged vessel.	Injury or loss of life due to broaching or capsizing.	A	0.001		\$125,000	\$125,000	\$125,000	Only one incident on record resulting in two fatalities (one civilian, one CG)
Overloaded or improperly loaded vessel.	Damage to boat due to water ingestion in engine.	D	0.001		\$42	\$42	\$42	Only one incident on record.
Failure of lifeline or related safety device.	Potential injury from fall or contact with object along side the vessel or through drowning.	D	0.002		\$0	\$0	\$0	

**Table 20. Preliminary Hazard Analysis for Overboard Hazard Group.**  
(Continued)

HAZARD	EFFECT	HAZARD LEVEL	ASSESSMENT					COMMENTS
			LIKELIHOOD	EXPOSURE	MAGNITUDE			
					Min	Max	Avg	
Maneuvering at high speed in a small boat such as a RIB.	Potential injury due to fall or contact with object while being tossed about. Damage due to loss of equipment when overboard.	D	0.001		\$0	\$0	\$0	Incident on record indicated weapon was lost but did not contain government costs.
Loss of steering control due to failure or malfunction of steering gear.	Injury due to the fall or collision with parts of the vessel, drowning on contact with water. Damage to vessel due to collision with another object while underway.	B/D	0.002		\$0	\$115,000	\$41,000	Steering casualties that result in overboard situations typically involve small craft operating at high speed.
Surface of the deck slippery due to ice, snow, soap or oil.	Injury due to the fall or collision with parts of the vessel, drowning on contact with water.	C/D	0.005		\$0	\$1,200	\$362	
Transferring objects between vessels or vessel and pier where the person needs to lean out or away from vessel.	Injury due to the fall or collision with parts of the vessel, drowning on contact with water.	B/C/D	0.002		\$0	\$2,055	\$810	
Performing maintenance work or other activities over the side of the vessel where attention is diverted from staying on board the vessel.	Injury due to the fall or collision with parts of the vessel, drowning on contact with water.	C/D	0.003		\$0	\$750	\$188	
Incomplete or improper maintenance operations of hoisting equipment resulting in equipment failure.	Potential damage or injury due when load is applied to lifting gear.	D	0.001		\$0	\$0	\$0	Data base contains only one such incident and does not report damage though the potential is great.

**Table 20. Preliminary Hazard Analysis for Overboard Hazard Group.**  
(Continued)

HAZARD	EFFECT	HAZARD LEVEL	ASSESSMENT					COMMENTS
			LIKELIHOOD	EXPOSURE	MAGNITUDE			
					Min	Max	Avg	
Small boat hitting floating object while traveling at high speed.	Injury due collision with parts of the vessel or drowning on contact with water. Damage due to collision with object.	D	0.002		\$0	\$8,000	\$3,387	This hazard involves the potential for considerable personal injury due to the forces involved.
Small boat towing, lifting, or lowering operations while underway.	Potential injury due to collision between the "mother ship" and the small boat or drowning upon water entry. Damage due to collision between vessels, or loss of equipment during capsiz or swamping.	D	0.003		\$300	\$4,675	\$2,302	Most hazards of this type involve RIB's

**Table 21. Preliminary Hazard Analysis for Radiation Hazard Group.**

HAZARD	EFFECT	HAZARD LEVEL	ASSESSMENT				COMMENTS	
			LIKELIHOOD	EXPOSURE	MAGNITUDE			
					Min	Max		Avg
Unprotected exposure to UV radiation generated during welding.	Flash burn injuries to eyes; potential for skin burns.	C	0.006		\$350	\$991	\$605	

Table 22. Preliminary Hazard Analysis for *Structural Failure Hazard Group*.

HAZARD	EFFECT	HAZARD LEVEL	ASSESSMENT				COMMENTS	
			LIKELIHOOD	EXPOSURE	MAGNITUDE			
					Min	Max		Avg
Failure of seals or hoses.	Burns and respiratory injury due to escaping hot or toxic liquids. Equipment malfunction or failure due to loss of critical fluid (coolant, hydraulic fluid).	C/D	0.013		\$0	\$6,000	\$1,430	
Wind, waves, wakes, or currents stressing boat structures and inducing unusual boat movements.	Damage or injury caused by falling or movement of structure.	C/D	0.009		\$1	\$5,105	\$1,177	
Poorly secured or suspended objects.	Results in falls when person is suspended and results in falling objects when objects are suspended.	C/D	0.014		\$0	\$7,635	\$1,987	
Equipment used or stressed beyond operating limits.	Damage or injury due to falling debris.	C/D	0.005		\$0	\$2,998	\$768	
Equipment strength or performance degraded due to fatigue, corrosion, or wear.	Hoist lifting more than capacity	B/C/D	0.029		\$0	\$501,630	\$15,175	
Improper use of equipment.	Lines break leading to falling objects.	C/D	0.013		\$0	\$10,000	\$1,210	
Working on or near unguarded moving equipment.	Injury due to contact with moving machinery.	C/D	0.002		\$0	\$495	\$205	



Table 24. Preliminary Hazard Analysis for Toxicity Hazard Group.

HAZARD	EFFECT	HAZARD LEVEL	ASSESSMENT					COMMENTS
			LIKELIHOOD	EXPOSURE	MAGNITUDE			
					Min	Max	Avg	
Insufficient atmosphere due to malfunctioning or improperly operated OBA's/respirators during fuel tank inspection, training/drills.	Respiratory/circulatory problems due to lack of oxygen; dizziness, nausea, and unconsciousness are some effects.	C/D	0.003		\$120	\$750	\$399	
Smoke generated from mechanical or electrical problems, or from fires external to the vessel.	Potential injury to crew members from smoke inhalation; damage to equipment such as the engine, lagging, turbocharger, battery. Potential smoke damage to the vessel; however, smoke usually indicates other problems.	D	0.010		\$0	\$21,896	\$2,409	Smoke is nearly always a hazard to crew members, so most mishaps with reports of smoke were reported here. Damage to the equipment is not directly caused by the smoke in these cases, but is related to the problem causing the smoke.
Solid particles or fragments in the air from dust, rust, or dirt; typically from maintenance activities such as grinding, welding; one case of silicon ejected from tube unexpectedly.	Eye injuries from solid particles, typically in the air, entering the eyes. Other injuries might result from exposure to these particles. Potential equipment damage if particles/fragments interfere with normal equipment operation.	C/D	0.010		\$0	\$6,675	\$680	
Fumes from materials such as paint thinner or remover, descaler, paint, primer, gasoline or fuel, cleaning solutions.	Respiratory or neurological problems, eye irritation from fumes. Potential for damage due to chemical reactions with equipment or vessel components.	C/D	0.006		\$0	\$6,180	\$1,885	



**Table 24. Preliminary Hazard Analysis for Toxicity Hazard Group.**  
(Continued)

HAZARD	EFFECT	HAZARD LEVEL	ASSESSMENT				COMMENTS	
			LIKELIHOOD	EXPOSURE	MAGNITUDE			
					Min	Max		Avg
Contact with sprayed/splashed toxic liquids. Potential for damage due to chemical reactions.	Eye injuries most common (with or without eye protection); skin irritation and blood poisoning due to liquids contacting skin. Potential for other injuries. Potential for damage due to chemical reactions.	C/D	0.020		\$0	\$2,715	\$339	

Table 25. Preliminary Hazard Analysis for *Vibration and Noise Hazard Group*.

HAZARD	EFFECT	HAZARD LEVEL	ASSESSMENT					COMMENTS
			LIKELIHOOD	EXPOSURE	MAGNITUDE			
					Min	Max	Avg	
Parts loosening and causing leak of a flammable material (fuel).	Loose part may prevent proper functioning of equipment. Damage to equipment caused by smoke or fire due to fuel leak.	D	0.001		\$0	\$0	\$0	Only one incident in the LERAMS database where the direct hazard was vibrations or noise.

## **APPENDIX E**

### **Coast Guard Vessel Hazard Definition:**

#### **Coast Guard Vessel System Hazard Matrix**

This appendix contains a single matrix illustrating the hazards that impact the Coast Guard mission areas of Operations, Engineering, Management, and the environment. These mission areas are defined in the main body of the report in Table 2.

# COAST GUARD VESSEL SYSTEM HAZARD MATRIX

	Operations Systems	Engineering Systems	Management Systems	Environment
Armaments and Military Explosives			PRIMARY	
Burns		secondary	PRIMARY	
Capsize	PRIMARY	PRIMARY	secondary	secondary
Collision with Object	secondary	PRIMARY	secondary	
Collision with Vessel	PRIMARY	secondary	secondary	
Contamination		secondary	secondary	
Electrical	PRIMARY	PRIMARY	PRIMARY	
Environmental Conditions	PRIMARY	PRIMARY	PRIMARY	
Equipment Failure	PRIMARY	PRIMARY	secondary	secondary
Ergonomic			PRIMARY	
Explosion	PRIMARY	PRIMARY	PRIMARY	
Fire	PRIMARY	PRIMARY	PRIMARY	
Flooding/Sinking	PRIMARY	PRIMARY	PRIMARY	secondary
Grounding	PRIMARY	PRIMARY	secondary	secondary
Impact and Shock	secondary	secondary	PRIMARY	
Leakage	secondary	PRIMARY		
Loss of Power or Control	PRIMARY	PRIMARY	secondary	
Mechanical	secondary	PRIMARY	PRIMARY	
Overboard	secondary		PRIMARY	
Radiation			PRIMARY	
Structural Failure	PRIMARY	PRIMARY	secondary	
Temperature Contact		PRIMARY	PRIMARY	
Toxicity			PRIMARY	
Vibration and Noise	PRIMARY	PRIMARY	secondary	
Primary effect	PRIMARY			
Secondary effect	secondary			